RAILROAD GAZETTE

FRIDAY, AUGUST 14.

The Basis for the Hire of Cars.

At the last meeting of the Car Accountants' Association the following report was submitted by the Committee on Per Diem and Mileage Basis for Hire of Cars, consisting of Messrs. Edmund Yardley, Pennsylvania Co.; E. M. Horton, Illinois Central; A. P. Wilder, Atchison, Topeka & Santa Fe; C. Brooke, Minneapolis & St. Louis; and S. O. Parker, Cincinnati, New Orleans & Texas Pacific:

Your committee, appointed to investigate the subject of the detention of cars and to suggest some plan for your consideration to remedy this matter, beg leave respectfully to report:

That, since their appointment, they have given all the time they could spare from their own duties to the consideration of this subject; that they have communicated with officers of roads whose opinions seemed valuable, and that they have derived many valuable suggestions from members of the Association who were not upon the committee. Three plans have been suggested as substitutes for the present mileage basis:

1. A penalty plan, similar to that in use in England, for cars that have been detained over a certain length of time.

2. A mixed per diem and mileage rate, which should follow the car from the moment that it was in the possession of the foreign road. And

3. A per diem rate pure and simple.

After weighing carefully, with what ability they had, these various propositions, they are unanimously of the opinion that, if any change is to be made, the most proper substitute for the present mileage basis is the last of these propositions, *i. e.*, a simple rate per diem. Having reached this point, their attention was next directed as to what the rate should be, and, with some minor differences of opinion, they have settled among themselves that 35 cents per day would be about the fair charge—the rate to be paid for every full day, including Sundays and holidays, that the car may remain in the possession of the foreign road; in regard to the how we have arrived at the rate of 35 cents per day. The following considerations have been those weighed by us: Average cost of a car at present is, say, $450; interest at 6 per cent, $27; average cost of maintaining the car and rebuilding when worn out, may be put at $60; total, $87.

This is about 25 cents per day that it costs the owners to keep up their equipment; and we see no reason why, if cars are loaned on the per diem rate, they should not pay something more than this. Cars cannot be leased, even where the company agrees to keep them a full month, short of $8 per month. We, therefore, think that when it is at the option of a road to receive a car when it feels like it, to return it just as soon or late as it pleases, that a rate of 35 cents per day is not far out of the way. We are well aware that our cars do not earn on foreign roads even 25 cents per day, under the present mileage rate, but they do earn to their owners not less than $1 per day when actively employed. Since the object of a change from the mileage to a per diem basis is to get cars home when they are wanted, we think that arguments based on the present amounts that the cars earn on foreign roads have less weight in determining the result than may, at first, be thought.

The New Henderson Bridge.

A correspondent of the St. Louis *Republican* thus describes the bridge over the Ohio River, at Henderson, Ky., which the Louisville & Nashville Co. formally opened for traffic on Aug. 5, and which is the first bridge over the Ohio below Louisville:

The bridge crosses the Ohio River at right angles to the current. The grade on both sides of the channel span is 74 ft. to the mile, and the height of the lowest part of this span above high-water is 53 ft. The highest stage of the water at Henderson is 46½ ft. above low-water. The channel span, which is near the Kentucky side of the river, thus provides for 100 ft. above low-water and 53 ft. above high-water. The channel span is 525 ft. from centre to centre of pier, and is said upon competent and recognized authority to be the longest triangular truss-span in the world. The great structure as it stands to-day if 3,688 ft. in length, having 16 spans proper and three supplemental and smaller spans.

The surface of the ground at Henderson is 75 ft. above low-water, while the ground opposite on the Indiana side is about 15 ft. above high-water, and maintains this for several miles toward Evansville. The railroad track leaves the iron bridge about 500 ft. from the Indiana shore on a timber trestle, the first half-mile of which is creosoted and on the same grade as the bridge. Two and one-half miles of green timber trestle follows this at an elevation of 3 ft. above high-water and from 15 to 30 ft. above the ground. Three miles from the river the road reaches an embankment, on which it continues to Evansville.

The bridge has 16 masonry piers besides the pedestals of the Kentucky approach. Piers 2, 13, 14, 15 and 16 have foundations in earth and on land, dry at ordinary stages of the river. The foundations of piers 13, 14, 15 and 16 are on a number of oak piles driven 20 ft. below low-water and sawed off so that they will never be exposed above low-water. Pier 3 has its foundations on the top of the sandy shale underlying the river bed at a depth of about 24 ft. Piers 4, 5, 6, 7, 8, 9, 10, 11 and 12 are built in wooden caissons sunk in position by the pneumatic process. These caissons are sunk from 4 to 6 ft. into the sandy shale except in the cases of the channel piers numbers 5 and 6, which are sunk 8 ft. into the shale.

The amount of lumber and iron used in the foundations is about as follows:

Piers Nos. 4, 7, 8 and 9, 150,000 ft. of white oak and 26 tons of iron bolts, etc., each.

Piers 5 and 6, 250,000 ft. of white oak and 33 tons of iron bolts, etc., each.

Piers 10, 11 and 12, 135,000 ft. of white oak and 20 tons iron bolts, etc., each.

Total in all caissons about 1,640,000 ft. white oak and 225 tons iron.

Upward of 20,000 yards of cubic stone were used in the work, about 16,000 yards having been laid in the past eight months. The channel piers each contain about 3,000 yards of stone. The width of the other river piers on top under the coping is 7 ft. The length of the spans from centre to centre of piers is as follows:

	Feet.		Feet
No. 1 to 2	76	No. 2 to 3	120
No. 3 to 4	249	No. 4 to 5	250
No. 5 to 6	525	No. 6 to 7	250
No. 8 to 9	249	No. 7 to 8	249
No. 10 to 11	249	No. 9 to 10	249
No. 12 to 13	120	No. 11 to 12	249
No. 14 to 15	120	No. 13 to 14	120
No. 15 to 16	120		

Three sets of pneumatic machinery were employed continuously at the bridge, and after beginning to sink a caisson, the work went on continuously night and day in eight-hour watches until the caisson had reached the required depth, and the working chamber had been filled solid with concrete laid in cement mortar. From 10 to 35 men worked in each caisson at a time. Often the steam did not go down, as the machinery did not stop for more than a moment for upward of six consecutive months. The caissons were built on cradles, and the launching of these masses, weighing from 400 to 700 tons, were always a matter of considerable anxiety. By an error of the workmen caisson No. 6 had one side buoyed up by the air, and was nearly overturned. The maximum pressure of air was about 30 pounds. The laborers in the caissons were generally negroes, and there was little or no trouble experienced from the caisson disease. On one occasion a storm came up in the night, and heavy waves were thrown over the top of pier No. 6, then about 5 ft. above the water, and for more than an hour communication with the men in the chamber was cut off, but all were rescued finally.

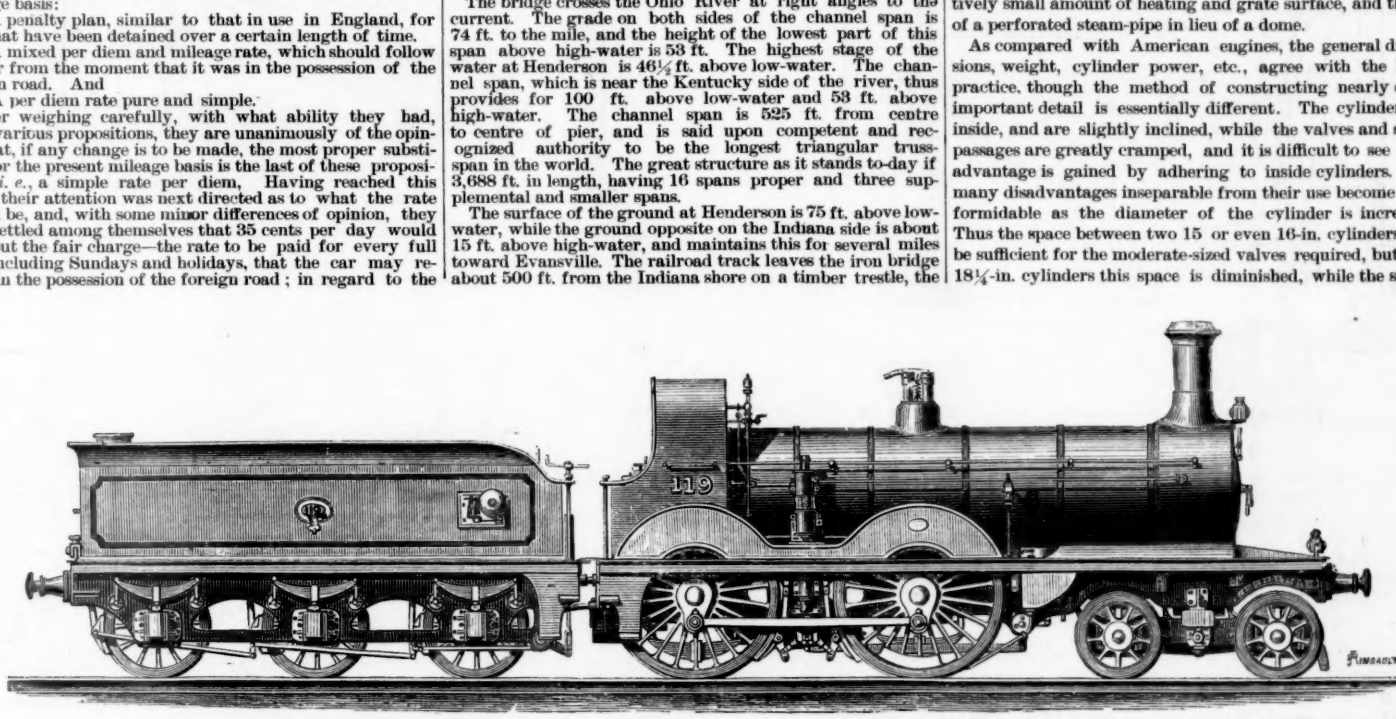
The Kentucky approach of iron trestle lengthens the ironwork of the bridge several hundred feet more. The vertical depth of the long channel span will be about 60 ft., and the top of the span 160 ft. above low water. The iron work was done by the Keystone Bridge Co.

The transfer track betweed Evansville and the bridge is a splendid structure, involving a cost of $300,000. There are 3½ miles of trestling, the balance being filled and well ballasted. Most of the piles are creosoted, which will make them almost everlasting.

Passenger Locomotive, Glasgow & Southwestern Railway, Scotland.

We are indebted to *Engineering* for engravings and dimensions of this engine, which differs in many respects from the usual practice in Great Britain, though engines embodying these unusual features have for many years worked very successfully on one of the best managed Scotch railroads. The principal points of difference are the use of steam reversing gear, the great size of the inside cylinders, the comparatively small amount of heating and grate surface, and the use of a perforated steam-pipe in lieu of a dome.

As compared with American engines, the general dimensions, weight, cylinder power, etc., agree with the latest practice, though the method of constructing nearly every important detail is essentially different. The cylinders are inside, and are slightly inclined, while the valves and steam passages are greatly cramped, and it is difficult to see what advantage is gained by adhering to inside cylinders. The many disadvantages inseparable from their use become more formidable as the diameter of the cylinder is increased. Thus the space between two 15 or even 16-in. cylinders may be sufficient for the moderate-sized valves required, but with 18¼-in. cylinders this space is diminished, while the size of



PASSENGER LOCOMOTIVE, GLASGOW & SOUTHWESTERN RAILWAY, SCOTLAND.

fractions of days, they are of opinion that no charge should be made. In coming to these conclusions, your committee are only expressing their own individual opinions at the present time. To make a change from the mileage rate as at present in vogue, to any other rate whatever, is a serious matter; as is readily apprehended when the amount of money paid for car service is considered. We do not believe that any change can be made at once; and in order to prove such change desirable, it will be necessary to show by statistics that it is, *on the whole*, beneficial. The subject is intricate, and careful consideration is demanded at every step. To the subject of switched cars, under per diem alone, we have given a very careful, prolonged, and, we believe, exhaustive examination, without being at all sure that, after all, some radically important point may not have been overlooked. So far, we are unanimously of opinion that any plan of per diem which does not include them at the same rate as other cars, will prove a failure.

We would, therefore, recommend that after our report has been discussed by the Association, either the present committee should be continued or a new and possibly larger one formed, who, during the coming year, may obtain figures as to actual performance under the mileage basis, compared with probable performance under the per diem plan, that may enable us to reach the important conclusion, *Will it pay?*

In closing, we wish to point out one thing that has been developed as a result of our deliberations: the roads that have the long hauls will likely be benefited by the adoption of the per diem rate, while the roads having the short hauls will, it would seem, have to pay out more than at present. For example, a car from Chicago to Pittsburgh and return travels twice 468 miles, and the Pennsylvania Co. pays at present for its use $7.01; this, it is readily seen, amounts to 20 days' use of car on the per diem rate. Every day that the Pennsylvania Co. returns that car under the 20 they pay less than at present. Now, 10 days would be considered at present ample detention for a car passing from Chicago to Pittsburgh and back, although loaded both ways; therefore, under a per diem rate, the saving to that company would be at least one-half of the present charge for all such cars. On the other hand, the Pennsylvania Co. receives, at Chicago, for switching, cars that are detained, on an average, by the consignee, two or three days; for these at present no mileage is paid, but on a per diem basis the amount paid per car would be, say, $1.05. This illustrates what takes place on a short road. The Pennsylvania Co. would pay out more, if the rate were per day, than at present; and the question with them would be, will they receive a like amount for their own cars; for which they at present receive nothing, and if not, will their loss be made up by some corresponding advantage? We would further add that the aggregate amount paid or received is of small matter in the consideration of this subject. Our attention should be directed exclusively to the balances paid or received.

It will probably be of interest to the Association to know

As compared with American engines, the general dimensions, weight, cylinder power, etc., agree with the latest practice, though the method of constructing nearly every important detail is essentially different. The cylinders are inside, and are slightly inclined, while the valves and steam passages are greatly cramped, and it is difficult to see what advantage is gained by adhering to inside cylinders. The many disadvantages inseparable from their use become more formidable as the diameter of the cylinder is increased. Thus the space between two 15 or even 16-in. cylinders may be sufficient for the moderate-sized valves required, but with 18¼-in. cylinders this space is diminished, while the size of the valves and steam passages should be increased. Similarly, the vulnerable point of the crank axle, the throws, are actually slightly thinner for the larger cylinder, and therefore the liability to break is doubly increased. Inside-cylinder engines are said to be slightly cheaper to build and weigh a little less at the forward end, as the cylinders and valve chests form in themselves the bracing between the frames; but these advantages seem dearly gained at the expense of contracted steam and exhaust passages, the inaccessibility of the working parts and valve faces, and the greater liability to fracture the main driving axle.

The engine would certainly run as steadily with a pair of level outside cylinders, while the dangerously weak crank-axle would be got rid of. The official Board of Trade Returns state that during the first six months of 1883, 239 axles of various descriptions failed in Great Britain, and of these 116, or nearly one-half, were crank or main driving-axles, the remainder being on tenders, passenger and freight cars, etc. The returns do not enable one to make an exact estimate, but it would appear that about one out of every 122 crank or main driving-axles failed, while only one out of every 11,400 other axles failed. Taking only the failure of engine axles, and separating the plain main driving-axles of outside-cylinder engines from the crank-axles of inside-cylinder engines, it would appear that one out of every 100 crank-axles fails in six months, while only one of 1,500 other engine axles fails in the same time. In other words, a road having 500 engines similar to that we illustrate, might reasonably anticipate that 10 crank-axles, and only 2 hind driving or truck axles, would break or show decided signs of failure during the year. The breakage of any axle on a train may cause great loss of life and property, and it seems hardly prudent to use a form of axle that appears to court disaster. Strange to say, however, inside-cylinder engines are more general in England now than they were 20 years ago, two lines especially having abandoned outside for inside-cylinder engines, though three out of the five Scotch railroads still use outside cylinders exclusively.

The engines we illustrate are built rather for general passenger traffic than for express trains, and are specially designed for working a competitive service against an older and more level line between Glasgow and Greenock. The section of the heaviest part of this line from Elderslie to Greenock, the respective birthplaces of two great Scotchmen, Wm. Wallace and James Watt, shows that the gradients are very

PASSENGER LOCOMOTIVE, GLASGOW & SOUTHWESTERN RAILWAY, SCOTLAND.

Fig. 4.

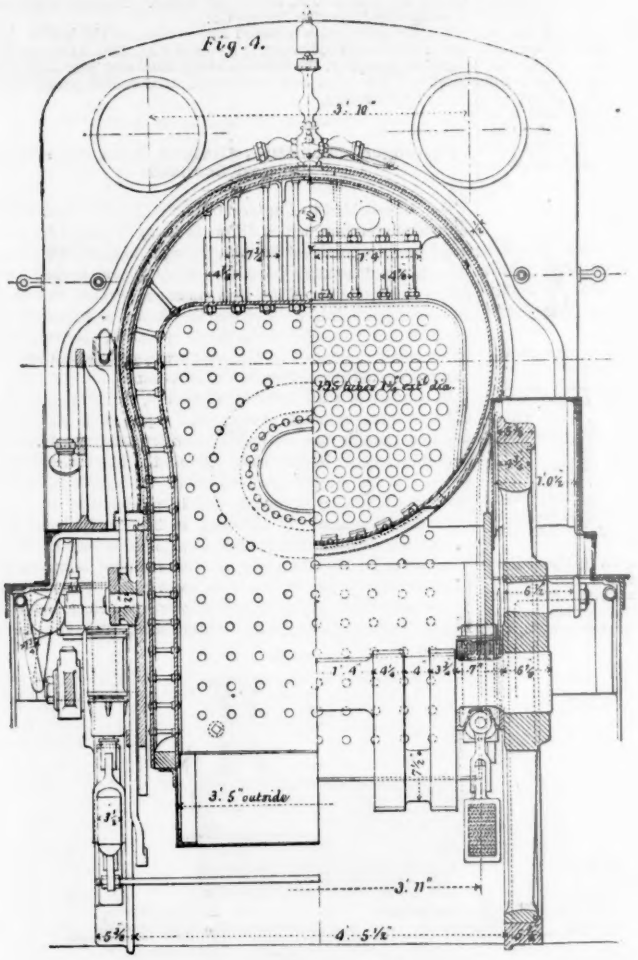
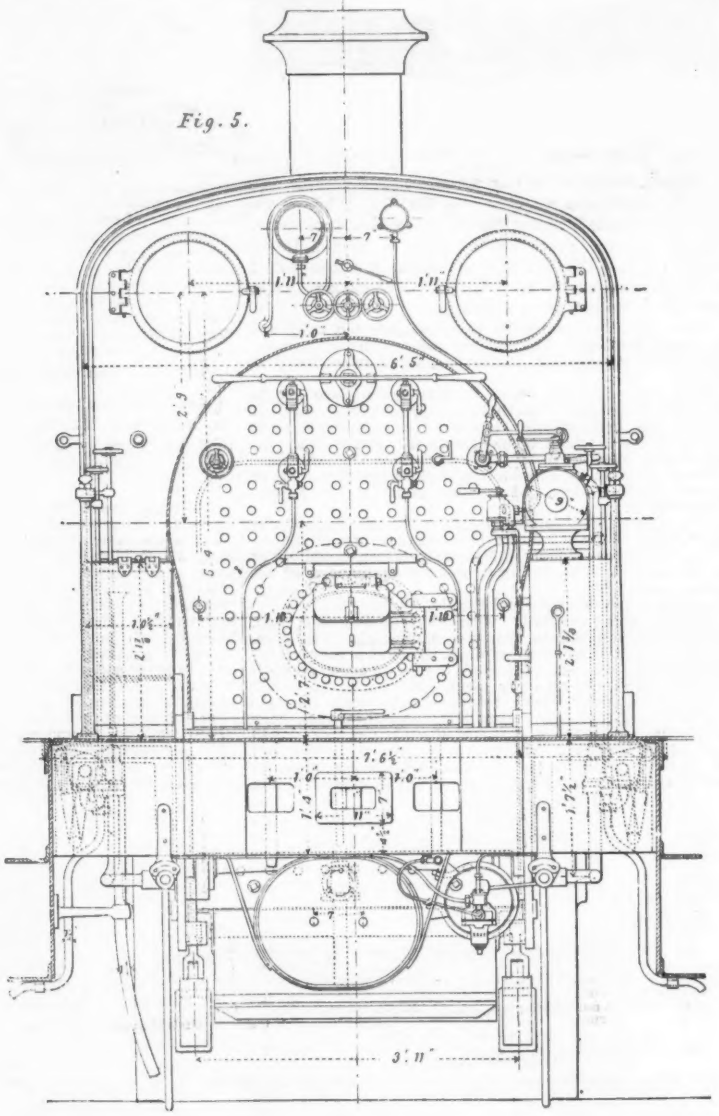


Fig. 5.



heavy, there being 3¼ miles of 75 ft. to the mile immediately after leaving Greenock. During the summer the passenger traffic, in connection with the river steamers, is very heavy, and must be run punctually at an average speed of 40 miles per hour. The work for some years was done by engines with cylinders 17 in. in diameter by 24 in. stroke, and having four coupled wheels 6 ft. in diameter, but as the four-wheel coaches were replaced with a heavier and better class with six wheels, in increased numbers, these engines became unfit to meet the work, and have been replaced with the class we now illustrate.

These engines, which have been constructed from the designs of Mr. Hugh Smellie, the Locomotive Superintendent of the Glasgow & Southwestern Railway, have cylinders 18¼ in. in diameter by 26 in. stroke, and the mean diameter of the four-coupled wheels being 6 ft., the tractive force is $\frac{18.25^2 \times 26}{72} = 120$ lbs. for each pound of effective pressure per square inch on the pistons. They are therefore the most powerful passenger locomotives in Great Britain. The front of the engine is carried on a four-wheel truck, which is found to be of special benefit on sections of the line where curves are numerous, and as will be seen from the engravings, side spring-cushion slides are used, which prevent any tendency to roll. A special arrangement of side springs is also used to control the lateral play; this arrangement consists in making the controlling springs on both sides of the centre-pin, or sliding central block, resist the lateral movement, so that to whichever side it moves both springs are compressed, instead of the springs on either side being alternately compressed and released, as in the arrangements ordinarily used. When the truck is in its central position, one spring, of course, neutralizes the other. By taking advantage of both springs in this manner, less rigid springs, having a larger limit of elasticity, can be used, and the travel of the sliding block is greatly improved, the rise in resistance not being so rapid, and all the tendency to jerky motion being removed. It will also be seen from the engravings that the rods on which the springs are mounted are carried through to the outside of the truck frames, so that it is a very simple matter, when in the round-house, to take up loss or tear and wear of the springs by screwing in the spindle, and putting an additional iron washer next the side frame, a suitable locking washer being used outside to prevent unscrewing after adjustment.

The driving-axles and all the engine tires are of crucible steel, the coupling-rod pins of best Yorkshire iron, case-hardened; the axle boxes of hard brass with white metal in the crown of the bearings; the axle-box guides are of cast iron, the front guides for the drivers being provided with a wrought-iron case-hardened wedge to take up the wear. The truck axles are of best Yorkshire (Bowling) iron with journals case-hardened, and running in phosphor-bronze bearings. The springs are placed over the axle-boxes, and connected with an equalizing lever, so as to insure proper distribution of the weight.

The pistons are of cast-iron, with two cast-iron rings in each; the piston-rods are of crucible cast-steel, and the connecting and coupling-rods of best Yorkshire iron. The steel slide-bars are supported by a motion-plate at some distance from their rear ends; this allows the cross-head to be withdrawn without taking down the bars, and adds to the rigidity of the bars, as they are supported nearer the point of the stroke where the connecting-rod assumes its maximum angle. It also enables longer eccentric-rods to be used. The valve motion is of Yorkshire iron, all pins and joints being case-hardened. The eccentric straps are of wrought iron with white or soft metal linings, the eccentric pulleys being of cast-iron. For the past 10 years all engines built for the Glasgow & Southwestern Railway have been fitted with steam reversing gear; the arrangement is very neat and most effective, not only being quick, but reducing manual labor to the minimum, and consequently engineers much prefer it to either lever or screw.

The boiler of the engine is of the flush-topped type, built telescopically, each barrel ring being of one plate with longitudinal butt joints in the steam space, these joints being double-riveted with outside and inside covering strips; the circumferential seams are single-riveted. All the boiler-shell plates are ½ in. thick, except the front and back plates of the fire-box casing, which are $\frac{9}{16}$ in. thick; the smoke-box tube-plate is ¾ in. thick. The man-hole is placed over the centre of the driving-wheels, the cover being utilized to mount a pair of Ramsbottom's direct-acting duplex safety valves, each 2½ in. diameter, loaded to a working pressure of 140 lbs. per square inch.

The inside fire-box is of copper ⅛ in. thick, except the upper part of the tube-plate, which is ⅜ in. thick. With the exception of those in the crown, the stays are of soft copper rod, 1 in. in diameter; the roof stays are 1 in. in diameter, of Bowling iron; the two rows next the tube-plate being supported from a special soft steel casting, riveted to the outside casing. This makes a very effective and simple job, dispensing with all joints, pins, etc., commonly used; 104 crown stays are used in all. The tubes are of brass, 195 in number, and 1¾ in. external diameter, arranged in horizontal rows.

The steam is collected by a perforated pipe, and the throttle valve, which is a plain gridiron slide-valve with a small riding relief valve, is placed in the smoke-box. The throttle valve is worked by a double-ended lever, so that it can be used by the engineer from either side of the cab. This is useful in switching. The cab is wholly of iron, and would be very uncomfortable both in summer and winter in our climate In the southwestern part of Scotland, however, it is seldom either very hot or very cold, though the frequent rains would seem to render a larger roof a very desirable addition to the men's comfort.

It will be noticed that a gong is placed on the side of the tender tank. This gong is connected to a communication cord running through the train, and in case of need can be actuated by the conductor or any passenger, but it is practically never used, and remains as a protection against the violent assaults which are occasionally committed by cranks in the isolated compartments of English cars. Should the engineer hear the gong struck, it is a signal to him that something is wrong, and the train is stopped to inquire the cause.

The injector steam valves, as well as the whistle and Westinghouse pump valve, are all fixed in one stand pipe, close to the front of the cab. The boiler is fed by two No. 8 brass injectors, one placed on each side underneath the cab and behind the step-board. The injectors are thus kept cool by the draught of air, the handles are easily accessible, and being beneath the water level in the tender, the cheaper form of non-lifting injector can be used. One injector is found ample to supply the engine when working ordinary trains.

The tender is of a form very general in Great Britain, where trucks are never used under tenders. The coal is carried on the sloping top of the rectangular tank, and has thus a tendency to slide down toward the fireman, and keep him constantly supplied. This line for many years continued to use wooden-frame tenders, but has lately abandoned them in favor of the iron frame, which may now be said to be universal on the other side. The tender is a standard for both passenger and freight engines, and this applies also to the valve gear, cross-heads, slide-bars, connecting and eccentric rods, and fittings generally, which are identical for express, passenger and six-coupled freight engines, thus reducing to the minimum the kinds to be manipulated in the several workshops, and also the spare parts necessary to meet repairs. Railroad men well know how much this conduces to efficient and economical working.

The engine and tender are fitted with the Westinghouse automatic brake, cast-iron blocks being used for the coupled wheels of the engine, and all the tender wheels, the engine-blocks being kept well below the centre line of the axles.

It will be noticed that the driver brake piston moves downward to apply the brake. The piston-rod is thus only exposed to flying dust and mud during the short time when the brake is on, and the piston-rod cup leather gland can be dispensed with. An ordinary coil release spring moves the piston up when the brake is released. This spring, however, takes up more space, and the piston is not so easily lubricated as with the usual arrangement of Westinghouse driver brake.

Most of the leading dimensions will be found on the illus-

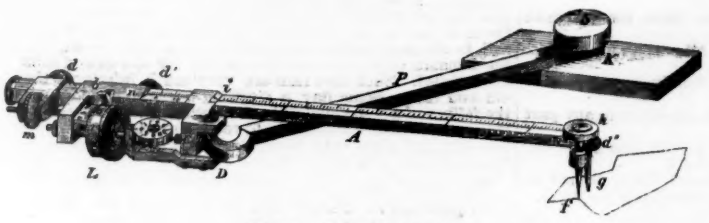


Fig. 1.—Polar Planimeter.

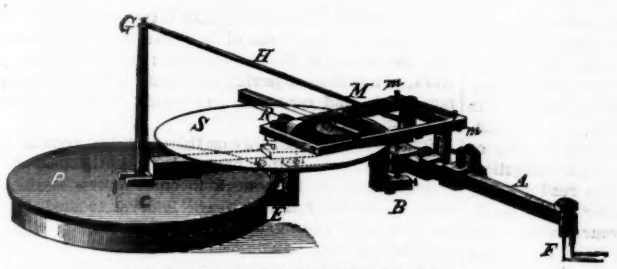
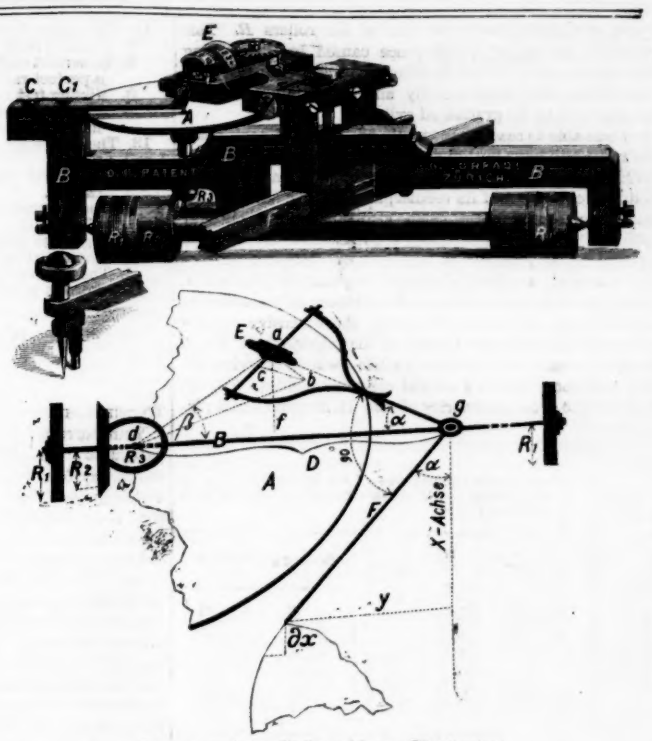


Fig. 2.—Suspended Precision Planimeter.



Figs. 3 and 4.—Rolling Linear Planimeter.

trations, but for the sake of facility of reference we subjoin the following table:

DIMENSIONS, WEIGHT, ETC., OF PASSENGER LOCOMOTIVE, GLASGOW & SOUTHWESTERN RAILWAY.

Kind of fuel used	Scotch bituminous coal.
Weight and General Dimensions.	
Gauge of road	4 ft. 8½ in.
Total weight of locomotive in working order (actual)	93,000 lbs.
Total weight on driving-wheels	62,200 lbs.
Total wheel-base	21 ft. 3 in.
Distance between centre of front and back driving-wheels	8 ft. 3 in.
Distance from centre of main driving-wheels to centre of truck	10 ft. 1½ in.
Length of main connecting-rod, from centre to centre of journals	6 ft. 0 in.
Transverse distance between centres of cylinders	2 ft. 4½ in.
Cylinders, Valves, etc.	
Diameter of cylinders and stroke of piston	18¼ in. × 26 in.
Diameter of piston-rod	2¾ in.
Diameter of valve spindle	1¼ in.
Size of steam-ports	16 in. × 1½ in.
Size of exhaust ports	16 in. × 3¼ in.
Greatest travel of slide valves	4¾ in.
Outside lap of slide valves	1 in.
Inside lap of slide valves	nil.
Lead of slide valves in full stroke	⅛ in.
Material of slide valves	phosphor bronze.
Sectional area of single steam pipe connected with cylinders	14 sq. in.
Wheels, etc.	
Diameter of driving-wheels, outside of tires	73½ in.
Diameter of truck wheels	36½ in.
Thickness of truck and driving tires	2¾ in.
Size of driving-axle journals, diameter and length	7 in. × 7 in.
Size of driving-axles in wheels, diameter and length	8½ in. × 6¾ in.
Size of truck axle journals, diameter and length	5½ × 9 in.
Size of truck axles in wheels, diameter and length	6¾ in. × 6¾ in.
Size of main crank-pin journals, diameter and length	7½ in. × 4 in.
Size of coupling-rod journals, diameter and length	¼ in. × 3⅞ in.
Thickness truck and main frames	1 in. and 1¼ in.
Length of truck springs, centre to centre of hangers	24½ in.
Number and thickness of plates	11 and ¼ in.
Camber unloaded	2½ in.
Material of tubes	Brass
Number of tubes	195
Diameter of tubes, outside	1¾ in
Distance between centres of tubes	2½ in.
Thickness of tubes, fire-box and smoke-box ends	11 and 13 B. W. G.
Cross-sectional area of flues	2.4 sq. ft.
Ratio of grate surface to total heating surface	1 to 66.5
Ratio of cross-sectional area of flues to grate surface	1 to 6.67
Smoke-box, length outside	33¼ in.
" breadth "	58¾ in.
" diameter of door	47 in.
" thickness of plates, front and sides	⅛ in. and 5-16 in.
Grate surface	16 sq. ft.
Heating surface in fire-box	101 sq. ft.
Heating surface of the inside of tubes	845 sq. ft.
Total heating surface	946 sq. ft.
Heating surface outside of tubes	964 sq. ft.
Tender.	
Diameter of tender wheels	46½ in.
Thickness of tires	2¾ in.
Size of journals of tender axles, diameter and length	5 in. × 9¾ in.
Diameter of tender axle centre and back of wheel	5¾ in. × 6¼ in.
Total wheel-base of tender	12 ft. 0 in.
Thickness of tank plates, top and bottom	⅜ in.
" " " sides and ends	¼ in.
Water capacity of tank (in gallons of 231 cubic inches)	2,550 gals.
Tank length, breadth and depth inside,	17 ft. 2½ in. × 6 ft. 7½ in. × 2 ft. and 3 ft. 6 in.
Coal capacity	7,000 lbs.
Thickness of main frame	⅞ in.
Engine and Tender.	
Total wheel-base of engine and tender	41 ft. 3 in.
Total length of engine and tender over all	49 ft. 3½ in.

A Large Pile-Driver.

The Central Railroad & Banking Co., of Georgia, has recently built perhaps the most powerful pile-driving car ever constructed, of which the following are the leading details:

Car-body, 44 × 10 ft., with 3 bolsters to enable the front truck to be moved back and let the front end carrying the leaders project, so as to drive bents 12 ft. apart.

Leaders, 40 ft., taking 50 ft. × 18 in. pile. Raised and lowered by putting the hammer to a central position and swinging on a pivot, by an arrangement quite novel in detail and said to be very satisfactory.

Hammer.—Nasmyth steam hammer, weighing 8,000 lbs. and striking 75 blows per minute, with 100 lbs. pressure. Raised and lowered by a 40 horse-power engine. Steam supplied by a 3-in. pipe from an accompanying locomotive, which passes up through the pivot of the swinging platform on which the pile-driving gear is carried.

	Lbs.
Weight.—Platform car only	32,000
Pile driving gear	39,000
Total	71,000

Distributed on the trucks as follows:

	Front truck in its Front position.	Back position.
Front truck	45,000	58,000
Rear truck	26,000	13,000
	71,000	71,000

Average working capacity, 40 piles per day. Time occupied in driving and setting a pile, about 10 minutes.

Some Improved Forms of Planimeters.

The planimeter is one of the most surprising instances of the application of the higher mathematics to aid the every-day work of practical men. Both its working and its construction are almost simplicity itself. Any one having the manual dexterity and skill in reading scales which comes from moderate practice in drafting can readily learn to use it well, and being purely mechanical in its operation errors of moment are far less likely to occur than in numerical work, while the saving of time is very great. Nevertheless no one but an expert mathematician could well have even conceived the idea, still less have embodied it in practice, and its invention was hailed with admiration by mathematicians everywhere.

The little instrument is already in wide and general use for certain purposes, but it deserves to be known better and used more wherever there are areas to be determined or altitudes to be averaged. Uses to which the machine is especially applicable are the computations of areas of maps, plots, or sections, indicator diagrams, automatic gauge records, etc., etc.

The earliest form of this instrument is the now well-known Amsler or Coradi polar planimeter, the most complex form of which is represented in fig. 1. Its complexity arises from the graduated scale-arm, which enables areas of any kind, as, for instance, acres or square miles, to be determined directly from a map of any scale. When the instrument is fitted simply to determine some single unit, as, for instance, square inches, it is very much simpler, consisting simply of two hinged bars carrying an indexed rolling wheel near the hinge, a pin at one end to stick into the drawing-board, and a pointer at the other to follow the outline of the area with.

This *polar* planimeter (so-called because one point of the instrument is fixed) is very accurate, but accurate as it is, it is not sensitive enough for many purposes. The comparatively large area corresponding to its vernier unit, and, above all, the injurious effect resulting from contact of the graduated cylinder with inequalities in a plat, are precisely these defects, the study of whose abolition has brought into existence some improved forms which are as yet but little known in this country, the sensitive suspended precision and linear rolling types, illustrated herewith. The principle of all these instruments is the same, but the details differ considerably.

To give some idea of the given accuracy in practical work and of the injurious effects of ridges in a plat, we have traced with the ordinary polar planimeter an area = 272 square inches, getting a mean error of 0.002. Creasing the same so as to give it the look of a somewhat abused field location map, the error was tripled. The contact of graduated cylinder and paper is obviously the great source of error in such a type, and it is evident that with its removal a great advance has been made toward a perfect instrument.

The suspended precision planimeter, fig 2, is put together derrick-fashion; that is to say, its tracing and pole arms, together with a hard india-rubber disk *S*, carrying the graduated cylinder *R* and the register wheel, constitute a mechanism that might be called the derrick's boom (horizontal in this case). This "boom" swings around the foot of a small mast rising perpendicularly from the centre of a leaded brass disk *P*, the anchor of the whole instrument. The tie rod *H* allows the "boom" to swing free of the plat, with the exception of the tracing point *F*. As the "boom" slowly revolves around the anchor slab, whose rim is cogged, the motion by proper gearing is transferred to the spindle at the point *E*, and of course to the disk *S*. The nature of the attachment of the registering apparatus is shown in the cut, and it is easily seen that the graduated cylinder will move in sympathy with the disk *S*. In this instrument, as well as in the linear rolling variety, the readings, by reason of improved graduation, are from 10 to 20 times as accurate as in the ordinary make. A modification of the type dispenses with the tie *H*, and uses in its place a supporting roller in contact with the plat. The valuable feature of non-contact of graduated cylinder and paper is, however, in no way lost sight of.

In fig. 3 (three-fifths full size) we show the latest advance, which would seem to reach very nearly to the ultimate limit of improvement in the instrument.

This so called "rolling linear planimeter" is the invention of Mr. Coradi, a well-known Zurich instrument maker, and differs from all others in working from a *line* instead of a *point* as its base, it having a parallel-ruler like motion. The inventor claims for it four valuable improvements: (1) The fineness of its vernier; (2) adaptability by reason of its linear motion to long narrow areas; (3) little affected by inequalities in the paper; (4) the accessibility of all parts for repair. Two rollers *R*, striated so as to discourage all tendency to lateral motion and rigidly connected by a shaft, bear a frame *B* and indirectly the whole mechanism. As the rollers have the same circumference and bear equal weights, *only* a rectilinear motion at right angles to the shaft is possible. The same shaft carries a mitre wheel R_2, gearing into a pinion R_3 and transferring the motion as shown in the cut to the smooth disk *A*, on which rest the graduated roller *E* with its vernier attachment and the register wheel. The axis of *E* should be parallel to the tracing arm *F*, and the entire registering apparatus in its frame is hinged and pivoted at right angles with the tracing arm *F*. The top bearing of the disk *A* is in a steel plate attached to the frame *B*, and is adjusted by means of two screws *c* and *c*. The register wheel reading up to 20 revolutions of *E* (= 20,000 vernier units) may for large areas be replaced by a differential wheel with a limit of 420 revolutions.

It is to be noted that a rolling motion in *E* is either induced by adhesion to the revolving disk *A*, by direct influence of the tracing arm, or, which is most often the case, by both.

This type is in the market in two sizes, one with a tracing arm *F* = 7½ in. in length and giving unit areas varying between 0.0009 and 0.0003 square inches, the other with an 11.8 in. arm and with units between 0.003 and 0.0008 square inches.

Its mathematical theory is simplicity itself to any one familiar with the higher mathematics, but would be unintelligible without such knowledge. Its practical use, however, requires no knowledge of the theory; but three practical points may well be borne in mind in using any planimeter:

(1). Adopt a slow rate of speed when using the instrument especially when the roller *E* is near the edge of the disk. The rate should be so regulated that during the revolution of *E* its graduation figures are recognizable. (2). Start with the trac-

ing arm at right angles to the axis of the rollers *R*. This neutralizes any error or difference caused by the tracing point not returning to exactly where it began. (3). See that all revolving parts revolve easily and accurately. This applies above all to the graduated cylinder.

Any one able to read and compute with the ordinary polar planimeter will have no difficulty in that respect with the improved types. The number of vernier units is read from the graduated cylinder and its vernier, and must be added to the amount represented (if any) in the register wheel. Their sum multiplied by a coefficient taken from tabular information pasted in the instrument box, will give the desired area.

The following tabulated statement, showing the maximum errors in the readings of various descriptions of planimeters, has been drawn up in connection with the extensive experiments made by Professor Lerber, of the Imperial and Royal Mining Academy of Leoben, in Austria, which experiments agree with those made by several other authorities. The table shows the great superiority of the Hohmann-Coradi planimeters:

Area in		The error in one passage of the tracer amounts on an average to the following fraction of the area measured by —				
					Rolling planimeter.	
Square centimetres....	Square inches.....	The ordinary polar plan, unit of vernier 1 sq. in.= 0.015 sq. in.....	Starke's linear planimeter, unit of vernier 1 sq. mm. = 0.001 sq. in.....	Suspended planimeter, unit of vernier 1 sq. mm. = 0.001 sq. in.....	Unit of vernier 1 sq. mm. = 0.001 sq. in.	Unit of vernier 1 sq. mm. = 0.001 sq. in.
10	1.55	1/75	1/588	1/625	1/625	1/1000
20	3.10	1/148	1/1000	1/1111	1/1000	1/2000
50	7.75	1/353	1/1852	1/2500	1/2000	1/3000
100	15.50	1/682	1/2857	1/4167	1/3333	1/5000
200	31.00	1/1274	1/4255	1/7143	1/5128	1/7693
300	46.50	....	....	1/9375	1/8000	1/10000

Pennsylvania Railroad Specifications for Steel Rails.

The following specifications, adopted Jan. 27, 1879, are those still in force on the Pennsylvania Railroad, but it will be observed that they do not give in full the methods actually taken by the company to protect themselves as respects quality, simply stating (par. 3) that "a test-bar" shall be "taken from a web of a rail made from each charge;" what is done with the test-bar not being specified. We are, however, favored by Mr. Wm. H. Brown, Chief Engineer, with the following details:

We have always considered as a test-bar a piece 1 ft. long and 3¼ in. square taken from the web of the rail (because this portion of the rail is generally the hardest on account of being rolled at a lower temperature than the head) supported at each end, leaving a space of 8 in. between bearings. This bar is deflected by a sudden pressure in the centre of the bar to an angle of 80 degrees from a straight line, and this angle was made the limit between good and bad tests as far as hardness was concerned. The test-bars were contracted to be taken out so that we would have the material to do what we pleased with it. A great many of these bars were analyzed for sulphur, carbon, silicon and manganese, and were also subjected to physical tests, namely, breaking strain, limit of elasticity and per cent. of elongation; but this was merely done to get some further information in regard to Bessemer metal that we did not at that time posses.

At one time we had a specification, in which the tensile strength was 65,000 lbs. per square inch, and an elongation in the test-piece of not less than 15 per cent. should be classed as No. 1 steel; and all steel in which the tensile strength was less than 65,000 lbs. and an elongation less than 15 per cent., was classed as No. 2 steel.

The specifications are as follows:

SPECIFICATIONS.

As it is the desire of the Pennsylvania Railroad Co. to have on the roads under their control none but first-class tracks in every respect, and as the rails laid down in these tracks form an important part in the achievement of this result, the Pennsylvania Railroad Co. have found it necessary to make certain demands in regard to the manufacture of their steel rails, with which the different rolling-mills and rail inspectors will be required to comply.

1. The steel used for rails shall be made in accordance with the "pneumatic" or the "open-hearth" process, and contain not less than 30 or more than 50 one-hundredths of 1 per cent. of carbon.

2. The result of the carbon test of each charge, of which the Pennsylvania Railroad Co. is to receive rails, and of which an official record is kept at each mill, is to be exhibited to the rail inspector.

3. A test-bar ¾ in. wide and about 10 in. long, is to be taken from a web of a rail made from each charge.

4. The number of the charge and place and year of manufacture shall be marked in plain figures and letters on the *side* of the web of each rail.

5. The sections of the rails rolled shall correspond with the respective templates issued by the Pennsylvania Railroad Co., showing the shape and dimensions of the different rails adopted as their standard.

6. The space between the web of the rails and *template* representing the splice-bar shall not be less than ¼ in., nor more than ⅝ in.

7. The weight of rails shall be kept as near to standard weights as can be demanded after complying with section No. 5.

8. Circular holes 1 in. in diameter shall be drilled through the web in the centre thereof, at equal distances from the upper surface of the flange and lower surface of the head, and 3 1/16 in. from the end of the rail to the centre of the first hole, and of 5 in. from the centre of the first hole to the centre of the second hole.

9. The lengths of rails at 60 degrees Fahrenheit shall be kept within ¼ in. of the standard lengths, which are 30 ft., 27½ ft., and 25 ft. That not more than 10 per cent. of rails of the shorter lengths, nor more than 5 per cent. of No. 2 rails, will be accepted on any one contract.

10. The rough edges produced at the ends of the rails by the saw shall be well trimmed off and filed.

11. All rails are to be straightened in order to insure a perfectly straight track.

12. The causes for a *temporary* rejection of the rails are—
1. Crooked rails.
2. Imperfect ends (which, after being cut off, would give a perfect rail of one of the standard short lengths).
3. Missing test reports.
4. A variation of more than ¼ in. from the standard lengths.

13. The causes for a *permanent* rejection of a rail, as a No. 1 rail, are:
1. A bad test report, showing a deficiency or excess of carbon.
2. The presence of a flaw of ¼ in. in depth in any part of the rail.
3. A greater variation between the rail and splice-bar than is allowed in paragraph No. 6.
4. The presence of such other imperfections as may involve a possibility of the rail breaking in the track.

Contributions.

The Hire of Cars.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Your correspondent "A.," in your issue of July 10, is impatient at "the interminable discussion as to whether roads should pay for the use of foreign cars by the day or mile," and suggests "that it brought up before an influential railroad body, like the Time Convention, the plan he advocates would, no doubt, have been acted on long ago." Now, without any disrespect to the members of the Time Convention, it would seem that the discussion was now being carried on in decidedly a more proper place, namely by the Car Accountants of the railroads; by whom, your correspondent may or may not know, the subject is now undergoing investigation, and before whom a report of a committee was read at their last meeting in Minneapolis, as well as a paper by Mr. E. G. Squire, who advocated the very plan that your correspondent thinks would be such a nice compromise between the per diem and mileage basis.

It may be indeed that your correspondent has read these articles, and on account of the recommendation of the committee for statistics and more light may have been led to his remark about "interminable discussion" and a suggestion that the "Time Convention" should take hold of it.

It would be rather interesting to know how far "A." represents anybody's views but his own, and for what railroad in particular he speaks. As a member of the committee before referred to, the writer had occasion to correspond more or less fully with parties in interest in this matter, and in place of a burning desire for a change, he is bound to admit that he found very great indifference as to making any change at all, and that by the very railroads that he believes will be most benefited by it.

The committee recommend that statistics be obtained to show if a change from mileage to per diem, or, in fact, any other change will pay. If "A." is in a condition to do so, let him figure for one month how the balance in money, would stand, on one *or more* railroads to whose books he can have access; if:

1. The home road had received payment per diem (or per his mixed plan) for all the cars they had absent on foreign roads during the month.

2. Per contra, they had paid for all foreign cars on their line on the same basis.

Let him compare this with the amounts at present received on the mileage rate, and he will soon be in a position to judge on which side of the fence the road for which he is figuring will be; and in my judgment he will forward the solution of the problem more than he can in any other way. I wish such statistics could be obtained from every important road in the country before the end of the year.

As there will probably be some difference of opinion as to the rate of 35 cents proposed, the problem may be put in this form: What rate *per day*, if any, will net the railroad the same as when the hire is calculated at ¾ cent per mile?

In regard to the mixed rate I shall be surprised, notwithstanding the able advocacy it has had, and the distinguished name quoted in its favor, if it will not be found to be more expensive and cumbersome than simple per diem, without any corresponding advantage. E. Y.

Poor Steel Rails.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In reference to the matter of "Poor Steel Rails," which has been recently discussed in your columns, I inclose you a scrap from the Philadelphia *Press* of 1st inst. When one sees such a display of intelligence as that, we may well feel discouraged at the dense ignorance which remains after all our efforts. I was much pleased with the *Railroad Gazette* editorial on the rail subject. I think Dr. Dudley has done most of the mischief, for I have had ocular evidence that he believed the steel should be as "soft as boiler steel." Managers of mills cannot, however, shield themselves behind him, as they should have fought his theories better than they did. The theory I have of the cause of soft rails which are, nevertheless, high in carbon, is one I cannot prove just now, and I am sure our people would not thank me to ventilate it, but I know that the best materials only have gone into some rails that were very bad. ROLLING MILL.

[The article referred to from the Philadelphia *Press* was the following note from the head of its editorial page:

The popular faith in the strength and durability of steel rails is liable to be shaken by the statements made in the *Railroad Gazette* by Mr. Hawks, the Chief Engineer of the Michigan Central Railroad. He finds that the steel rails purchased for his road do not nearly survive the period of guarantee, but speedily begin to flow at the ends and spread at the sides and change the shape of the entire head of the rails. Rails laid as late as 1884 have had to be removed already on account of crushed ends. Mr. Hawks contents himself with giving facts, leaving others to find the reason for them. The *Scientific American* for July 25, in an article on "Railroad Economy," written without reference to or knowledge of Mr. Hawks' statement, gives what is perhaps the explanation of the softness of the rails furnished to his company. It says that the demand of the railroads for cheap rails has led manufacturers to work in slag and cinder with the steel, and in that way turn out a fair-appearing shoddy rail, in the manufacture of which there is a small profit, and the demands of the railroad companies for low-priced rails are satisfied. Such steel rails are very much inferior to the old iron rails. Some day a startling catastrophe through the failure of a "shoddy" rail will raise the question whether the state prison is not as ready to receive manufacturers who mix slag and ashes with their steel as it is to take builders who mix mud with their mortar.

We regret that our correspondent, who should be well qualified to discuss the subject from the manufacturers' standpoint, should have confined himself to satirizing the above display of newspaper science instead of giving his own views of the cause of and remedy for the great evil in question.—EDITOR RAILROAD GAZETTE.]

Piece Work in Railroad Shops.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I notice in your issue of July 10 a letter on this subject, from Mr. Frank C. Smith, who seems to consider that piece work, or a system of paying by results, is only applicable to new work, and cannot be carried out in repairing locomotives and cars.

Some personal experience on this point has convinced me to the contrary. After having been accustomed in my younger days to piece work in building new engines and cars, I was after a few years' interval somewhat unexpectedly called upon to take charge of the repair shops of a railroad that shall be nameless.

I found that the repairs were always in arrear, though the number of men employed and the stock of machine tools appeared ample for the number of engines on the road. This was partly caused by the shafting running at little more than half the speed for which the countershaft pulleys had been calculated on by the various makers of the machine. Leaky air flues in the smith's shop and foundry also made rapid work impossible. But even when these and many other matters were put right, the number of engines waiting their turn for repairs still appeared to me unnecessarily large. Engines that were badly wanted on the road seemed to be glued to the erecting-shop when once they got inside its doors. No 34 was waiting for the boiler-makers, No. 18 wanted a little painting; the lubricators, gauge cocks, etc., of No. 21 were not yet ready, and so on to the end of the chapter. This state of things had to be remedied, and I determined to put the whole force as far as possible on piece work The chief foreman was certain that this would result in a strike. However, a list of piece-work prices for all boiler-work repairs was drawn up, giving generally a price per rivet or per stud or per stay for repairs to shells, fire-boxes, ash-pans, tanks, smoke-boxes and other classes of work. When finished, I went over the list with the foreman, who suggested certain additions, and finally a complete list of prices was agreed upon.

After a couple of months a comparison of the cost of similar repairs showed that the piece-work jobs were done in about half the time, as compared with the old day-work system. Moreover, the men made a handsome profit over their usual day-work pay, the excess being from 25 to 60 per cent., though the work was actually done at less cost to the railroad.

As fast as the proper blanks could be printed, and the prices agreed upon, the piece-work system was extended to all the fitting, erecting and machine work. The various items were divided up as much as possible. For instance, separate prices were made for boring, planing, slotting, fitting and babbitting a driving-box, and where the expense would differ materially, separate prices were given for the driving-boxes of different classes of engines.

The introduction of piece work stimulates the use of standard sizes and interchangeability of parts, because uniformity greatly cheapens and facilitates repairs. It also enables more work to be turned out in a given time by a certain plant, and it enables the good and rapid workman to reap the benefit of his superior skill and industry.

On the other hand, there is a temptation to pass over defects in order to save the time necessary to put them right. This can only be guarded against by a more careful and rigid inspection of work by the foremen. To carry out piece work successfully first-rate foremen are absolutely necessary, and they should be so well paid that they earn more than any of the men in their shop.

A good system of piece work is not easily inaugurated, and once set going its workings must be carefully watched, but it is a valuable stimulus to the energy, industry and skill of those concerned, and if properly conducted cannot fail to give satisfaction all round. N.

A Method of Indicating the Age of Ties in Track.

Allegheny Valley Railroad, River Division,
PITTSBURGH, Pa., July 16, 1885.

TO THE EDITOR OF THE RAILROAD GAZETTE:

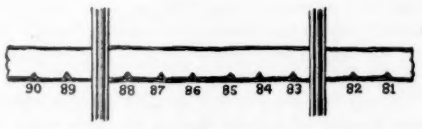
When, in walking over a piece of track, the condition of the ties is noted, the question often arises, "How long have these ties been in use?" It is believed that this question is not often answered without the use of the word "about." If inquiry is further pursued, it will probably be discovered that there is a period of from one to two years over which the haze of uncertainty lingers. Changes have occurred in the personnel of the sections or divisions since the ties on this or that particular piece of track were last renewed, and the new-comers

cannot speak of their own knowledge. Or, if the roadmaster or section-foreman who laid the ties is still on hand to answer the question, he too finds it impossible to reply without saying "about," for his memory (unless it be a phenomenal one) cannot retain in its grasp the exact date when each and every tie, or batch of ties, was laid.

And so it comes that, when those who rank as railway experts write upon the subject of the durability of wooden cross ties, their utterances often lack even the semblance of exactness. An alternative form of statement, such as "from six to eight years," or "from seven to nine years," or "from eight to ten years," is the expression generally employed.

It is believed to be advisable to obtain definite information on this point, not only for the benefit of the statistician or economist who may wish to be able to speak with precision on a vital point in railway expenditure, but for the every-day use of the operating department, so that "he who runs may read" the always-present record of age in ties.

We commenced to mark ties on this division in the year 1881, and adopted for our process the simplest and most available method that occurred to us, viz.: an inverted V cut in the upper face of the tie, made by a few strokes of an ax, hatchet or adze in the hands of a section laborer. The same



[NOTE.—Only one of these notches appears on *any one given tie*, varying according to the date at which it was laid.—EDITOR.]

method of marking has been pursued each succeeding year, the only variation being in *the position of the marks*, which is varied each year in accordance with a plan which can be readily understood by reference to the accompanying diagram, in which the tie is shown to be divided into ten imaginary spaces, two on the outside of each rail and six between the rails:

Thus, in the year 1881, we marked our ties with an inverted V close to the right edge of the tie (outside the right hand rail looking south). In 1882 we made the same mark just four inches outside the same rail. In 1883, we crossed this rail, and marked the tie just four inches inside the rail; in 1884, we marked at a point one foot inside the rail, and in 1885, we are marking the tie two feet inside the rail.

It is proposed to use the various remaining spaces inside the rails for the years 1886, 1887 and 1888; and the two remaining spaces outside the left-hand rail will be available for the years 1889 and 1890.

As a help toward readily conveying to every man's understanding the exact significance of each mark, our good fortune in having the year 1881 (the first year of the decade) for a starting date can be appreciated. If I were presuming to tender any advice in this matter to others, I should say to commence marking in 1885 or 1886 well toward the centre of the tie, so that at the commencement of the next decade the marks would come right for the successive years.

It is presumed that in the year 1891 very few of the ties laid in 1881 will yet remain in the track, to breed contusion by the similarity between their marks and those on the 1891 ties; but should happily this supposition prove erroneous, and a fair number of the 1881 ties still survive at the end of the decade, it will be apparent that a continuance of this system of using the same mark in different positions to indicate different years may be had by simply marking the other edge of the tie, thus affording a period of 20 years before the location of the first notch must be used again, which will surely carry us beyond the life of the oldest wooden tie, unless it be some of those almost immortal catalpas we hear of, but which in this part of the country we rarely see.

I find that this plan is easily understood, that it does not require the use of any special tool or material, that its cost is inappreciable, that the cutting of the tie to the extent necessary to insure permanence as a mark need not be so deep as to impair the tie in the least degree, that it is already a matter of considerable satisfaction in inspecting track to be able to know to a certainty how old the ties are, exactly the same as it is to be able to tell by the maker's marks, if any question arises, just how old the steel is; and we expect that the value of the marking will increase as the ties grow older, and as the time approaches when the question of the renewal of ties laid in 1881 is to be considered. In 1886 or 1887 there should not be any mistakes made by new foremen in taking out ties that have only been in five or six years, under the belief that they have been in the allotted span of about eight years.

Let us hope, however, that long before this or any other system of marking wooden ties can become general, some of the leading roads of the country will have demonstrated to us the great economy of a better material than wood for ties; and then another system of marking ties, that contemplates a longer term of use than 10 or even 20years, will be in order, and a saving in annual outlay for maintenance only second to that resulting from the substitution of steel for iron rails will have been inaugurated. CHAS B. PRICE.

[The plan suggested seems an eminently practical one. The writer, many years ago, proposed a different method for accomplishing the same end, which more by accident than otherwise failed to be carried through, viz., to use small copper nails stamped with the digits 0 to 9 to indicate the date of laying, changing the pattern of the nails at the end of a decade if it appeared desirable. The cost of this would be merely nominal, and the nails might be extracted and returned when the tie was removed in lieu of a report. Each plan would seem to have certain advantages, but that suggested by Mr. Price has the great one that the age of the ties can be noted as one is riding over the track. That the information obtained will far more than repay the trouble involved seems very clear.—EDITOR RAILROAD GAZETTE.]

TECHNICAL.

Compressed Air Motors for Street Railroads.

About two years since we described a system of air-driven tram cars which was then about to be adopted on the Caledonian road line of the London Street Tramway Co.'s system. This was the Mékarski system, and the car which was then experimented with was put on for regular traffic, and was worked on that road for about four months, taking its turn with the pair horse cars. It was intended then to displace the whole of the horse-worked cars on this line by 10 air-driven cars, but various delays occurred which prevented effect being given to the intention until the present time. Now, however, arrangements have been completed, and the first of the series of cars will very shortly be placed on the line for regularly working, to be followed in due course by the other nine which are being built. Since our previous notice, however, several improvements have been introduced into the details of the air engines, which are now made upon the compound principle. The high pressure cylinder is 5¼ in. and the low pressure 8 in. in diameter, with an 8-in. stroke, and through these the compressed air from the reservoirs is successively used. Means are provided by which the high pressure air can be used in the low pressure cylinder if necessary. The engine house containing the air compressing machinery is situated at the Holloway road end of the tramway line, where there are boilers, engines and pumps, by means of which atmospheric air is compressed, at a pressure of 450 lbs. per square inch, into reservoirs placed in the engine house. From these reservoirs the air is conveyed to the tram car through charging pipes with proper couplings, which are connected up for charging and disconnected when the reservoirs on the car—which are placed underneath the platform—are charged to the necessary pressure. The principal feature of the system, however, is that the air in passing from the reservoirs on the tram car to the cylinders of the engine is conducted through boiling water and steam at a pressure of 60 lbs. to the square inch, which is contained in what is known as a hot pot. This hot pot is charged at the compressing station while the car reservoirs are being filled with compressed air. By this means the heat which the air takes up during its passage through the hot water not only causes the air to expand but prevents the formation of snow in the cylinders and at the exhaust. The working pressure in the high pressure cylinder ranges from 150 lbs. down to 50 lbs. per square inch, and can be varied at will. There are efficient brake arrangements, and all the other requirements of the Board of Trade have been amply met. The first of the series of cars for the Caledonian road line was inspected last Saturday at the Inventions Exhibition by a number of gentlemen interested in tramway locomotion. They were received by Captain Clipperton on behalf of the company, and the construction of the engine and its working were explained by Mr. Harris, for Sir Frederick Bramwell, who is the engineer of the Mékarski Co., but who was unavoidably absent. The car was run to and fro on a short line in the south promenade of the exhibition, its working powers being satisfactorily demonstrated over such severe curves as could not occur in practice. We may add that the tram cars upon the Mékarski system have been successfully working on the tramway lines at Nantes, in France, for the last six years.—*London Times.*

Comparative Merits of Anthracite and Bituminous Coal.

The conclusions of a board of officers recently appointed by the Navy Department to investigate the comparative merits of anthracite and bituminous coal for naval uses, may be summarized as follows:

Heating Power.—The Navy Department was originally induced to employ anthracite, chiefly in consequence of the report of Prof. Walter R. Johnson, in 1844, that the evaporative efficiency of average anthracite was superior to that of bituminous coal, the figures being 9.5648 lbs. of water evaporated per pound of coal in the former case, and 8.944 in the latter; but this did not properly allow for the loss by the necessary cleaning every 12 hours, which causes loss of evaporative power in the following ways, to which the fires of free-burning coals are subject in a much less degree: (1) By the direct loss of heat in the earthy matter and ash removed; (2) by the unavoidable loss of some unconsumed coal during the abstraction of the clinkers; (3) by the influx of cold air during the operation of cleaning fires; (4) by the loss of heat expended in raising the temperature of air over and above the quantity needed for combustion; (5) by the loss of effect during the time that the fire newly cleaned requires to recover full action. The average evaporative power of the semi-bituminous coals is higher than the average evaporative power of the anthracites, being 9.9804 and 9.5648 lbs. of water from 212° F., respectively. Their conclusion is strengthened by results of Isherwood's experiments with several marine boilers, some, however, being flue boilers, in which Cumberland semi-bituminous coal generally evaporated more water than Pennsylvania and other anthracites. And these results are further corroborated by experiments of the Baltimore & Ohio Railroad, in which the evaporative effect of 1 ton of Cumberland coal was found equal to that of 1¼ tons of anthracite.

Weight of a Given Bulk.—The average of all the semi-bituminous coals of Maryland gives rather the smallest space occupied per ton (42.0372 cubic feet), the anthracite ranking second (42.13 cubic feet), the bituminous coals of Pennsylvania being third, but with very trifling difference (42.671 cubic feet), the coking coals of Virginia being the only free-burning varieties which are decidedly lighter (45.8804 cubic feet), indicating that anthracite is the heaviest class of coal.

Deterioration.—It is probably true that anthracite will scarcely deteriorate in heat-giving power except after long exposure to the direct action of the sun, as in the coal piled on the sandy beach at St. Paul de Loanda from about 1862 to 1882, for the similar coal at Fernando Po, having been overgrown with weeds and trees, and therefore sheltered from the rays of the sun, was almost as efficient after 20 years as when it was fresh. The free-burning coals, on the other hand, rapidly lose their cohesion and heat-giving power. Anthracite, under favorable circumstances, would last almost indefinitely.

Other advantages of anthracite are: freedom from smoke and soot and from danger of spontaneous combustion. Its disadvantages are: its slowness of ignition, which is a very serious disadvantage for naval service in time of war; the loss from incomplete combustion before alluded to, and the loss from slack, anthracite slack being worthless, while bituminous is tolerably efficient. In injurious effect upon boilers and grates the report considers that there is not much to choose, at least with iron boilers, for, whereas the intense local heat of an anthracite fire searches out and develops any tendency towards blistering or lamination in boiler iron, there are several varieties of free-burning coal which contain sulphur, and which are injurious on that account to tube-ends, etc. Both classes will, under certain circumstances, warp and destroy grate-bars.

Sinking Artesian Wells.

An interesting and full paper, with many illustrations, on "Drilling and Boring Artesian Wells as practiced in the United States of America," by C. W. Darley, now of New South Wales, has recently appeared in *Engineering*, from which we extract the following as to cost: "As regards the cost of boring or drilling, I found nearly the one price ruled all through the country; no matter what kind of apparatus was used, a set contract price seems to have become established. What the net cost was I could not well find out, but of course it would vary a little in every case, but seeing the eagerness with which contractors sought for and took orders, it is evident the contract quoted below pays well.

"The rates are as follows:

Ft.	Ft.	Ft.				
0	to 100	= 100	at 50 cts.	per	foot	$50.00
200	" 300	= 100	" 75	"	"	75.00
300	" 400	= 100	" $1.00	"	"	100.00
400	" 500	= 100	" 1.25	"	"	125.00
500	" 550	= 50	" 1.50	"	"	75.00
550	" 600	= 50	" 1.75	"	"	87.50
Cost for boring hole 600 ft. deep						$512.50
To this must be added cost of casing, which, as before mentioned, cost when riveted 75 cts. per foot.						
600 ft. 7-in. casing, at 75 cts						450.00
Add to this the cost of boarding the contractor and his two men, as I found it was the practice for the farmers for whom the work was being done to keep them while at work, say three men for six weeks = one man for 126 days at 50 cts						63.00
Or $1.71 total cost for a 600-ft. hole per lineal foot						$1,025.50

"If a length of 6-in. casing had to be used, the cost would be reduced a little. I have allowed six weeks for the boring; this is the outside time a 600-ft. hole would occupy, unless some serious mishap occurred to delay the work. I have already mentioned a case where with the hydraulic boring apparatus a hole had been sunk over 500 ft. in 11¾ working days. It must be borne in mind, however, that in this case a steam engine was used, and when an allowance is made for procuring water, fuel, stores, etc., the cost of the work will nearly mount up to as much as the slower horse-power machine."

The pound sterling has been converted into dollars at the rate of £1 = $5, which makes the prices given about 3 per cent. too great—unless the author reduced dollars to sterling at that rate, as he probably did.

Proposed Tunnel to Prince Edward Island.

When Prince Edward Island joined the Confederation of the British American provinces that now form the Dominion of Canada, one of the stipulations was that the Dominion Government should establish a regular steam communication winter and summer between the island and the mainland, the winter communication heretofore having been solely by a dangerous and intermittent boat service. It is now proposed to carry an iron tunnel or sub-way across the straits, which are nowhere more than 90 feet deep, as follows:

Total distance, shore to shore	8½ miles
Two long piers extending to 5-fathom line	3¼ "
Crossed by concrete lined iron tube, 10 ft. clear opening at each end (1¼ miles in all)	5¼ "

of which the first ½ to ¾ mile is in dredged channels two miles directly on the bottom, two miles on piers 100 ft. apart, hollowed at the top to receive the tubes, and varying in height from 5 ft. to 35 ft., each pier consisting of a cylinder of boiler plate from 20 ft. to 30 ft. in diameter, sunk to a good foundation from the surface by air-locks, filled with cement to the height required, and then the upper portion of the cylinder removed. There will be about 100 of these piers altogether, of which 25 will vary from 20 ft. to 35 ft. in height, another will be from 10 ft. to 20 ft., and the rest below 10 ft.

The subway will consist of a boiler-plate shell ⅝ in. in thickness, lined with 2 ft. 6 in. of concrete, leaving an opening of 10 ft. in diameter, which is sufficient for the 3½ ft. gauge of the Prince Edward Island Railway to pass its cars through. The tubes forming this portion will be riveted together in lengths of about 300 ft. on the shore, then launched, and a thickness of 14 in. or 15 in. of cement put in, or sufficient to bring them within 30 or 40 tons of their sinking weight; they will then be taken to their position and sunk by water ballast, and then connected with the portion already laid.

The estimated cost of this interesting work, exclusive of the end piers and approaches, which are considered as belonging to the railroad companies, is "not much in excess of" $2,000,000, excluding also an unknown amount of dredging, which "may cost" $250,000. The estimate seems extremely low for such a work. The island is only about as large as Long Island, and has probably less than 125,000 inhabitants, and a large cost for uniting it to the mainland is not warranted as it would be were the island larger and more populous.

Building a Paddle Wheel.

A paddle wheel for a large steamer is a complicated affair, says the Boston *Herald*. In the new one just made for the "Empire State," there are 444 pieces of white oak, measuring 5,640 feet and weighing 28,500 pounds. Of wrought iron there are 5,042 pieces, weighing in all 11,912 pounds. This gives a total of 5,486 pieces of wood and wrought iron in the wheel, weighing in all 40,412 pounds. To complete this work in six days and nights the services of three gangs of 12 men each were required in reliefs of 8 hours each.

Cost of Carriage by Rail and Canal in Germany.

A canal from the Westphalian coal district to Emden being projected, the following estimate was made of the cost of carriage upon canals and on a single track mineral railroad with a few stations and a small staff, assuming eight trains of 60 loaded cars per day to the port, of which 12 return loaded, and a cost of nearly $50,000 per mile for building the line, as actually incurred for similar lines in the district. The figures are cents per train-mile:

Repairs and renewals of locomotives	3.85
Fuel	7.70
Cleaning oil, etc	1.73
Repairs and renewals of cars	9.25
Lighting and heating of guard's van	0.70
Drivers' wages, including mileage	4.53
Guards' and brakemen's wages, including mileage	7.90
Inspection, etc., of rolling stock	0.42
Station service	10.02
Permanent way, repairs, and signalmen	13.87
General management	5.01
Total operating expenses	64.98

Interest on cost of construction and equipment brought the total cost up to $1.11 per train-mile, or 0.32 cent per ton-mile. The cost of transportation on various canals was:

Elbe Canal	0.70 ct. per ton-mile
Belgium to Paris	0.62 ct. " "

without interest on cost of construction.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Passes.—*All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.*

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

THE CAUSE AND CURE FOR BAD RAILS.

The last issue of the *Iron Age* reprints the letter of Mr. Hawks which appeared in our issue of July 24, in which the unhappy experience of the Michigan Central Railroad in respect to soft steel rails was detailed, and also portions of our discussion of the matter in an editorial which, while agreeing with our views in the main, expresses some opinions which invite further discussion.

When an evil is to be corrected, the first and most important thing is to recognize its true cause, in order that a remedy may be sought in a right way. We therefore regret to find the *Iron Age*, evidently speaking from the stand-point of the manufacturer (as it truly says we spoke from the buyer's stand-point), laying much stress on two alleged causes for the evil, both of which seem not only inadequate but, to speak frankly, preposterous.

The first of these is that "railroads have allowed the character of their road-beds to deteriorate and have unduly increased the weight of rolling-stock." While liberty of opinion cannot be denied in this country, such an explanation strikes us as weak indeed. The character of road-beds has not deteriorated, but improved, immensely and almost universally improved, since the introduction of steel rails, and if it be true that the weights of rolling stock (*i. e.*, of locomotives, which do most of the damage to rails) has increased somewhat faster than the average weight of rails—which we are not prepared to admit—the fact is nothing to the purpose. The complaint is, not that rails fail under worse conditions than rails were exposed to ten or fifteen years ago, but that new rails fail speedily, in increasing proportions, under *the same* conditions as, and in the immediate vicinity of, older and better rails which have sustained for many years *and are still sustaining* the traffic which destroys the newer rails.

The second explanation offered is even less defensible than the first; viz., that "the craze for cheapness" has led to "beating down the mills to the lowest point attainable" until "it is not surprising that they get what they pay for." No doubt such a doctrine would be very satisfactory to rail-makers, or any one else with goods to sell, but surely no one can seriously propose that buyers should stop buying as cheap as they can as a remedy for bad quality. This short and easy remedy, it is true, seems to have some adherents in the matter of car-wheels, for there would seem to be too many ready to admit in effect that sufficient evidence that a wheel is good is that it cost $11, and that no other need be sought; but it is new to hear the moral duty of paying a high price insisted on as one of general application.

At any rate, all expectations that, even if tried, it will cure the evil, we may be certain will ever be doomed to disappointment. We might even go further and say that, in a sense, it is for the public interest that this should be so, but it is enough to say that it is against the natural tendency of business.

That this is so is easily seen. A manufacturer is and should be engaged in a constant struggle not only to cheapen the cost of his products, but to produce new and cheaper products which will "fill the bill" as well, and hence command, for a time at least, the same market price. In doing this he is not a public enemy but a public benefactor; but it is obvious that, not only has he no further interest in the goodness of his products than that they shall be good enough to sell in competition with other similar products, but that he has no other criterion by which to judge of their goodness when (as in the case of steel rails) he does not himself consume the article he produces. In the course of the many experiments which—often at great expense—he makes to cheapen his products, it is inevitable that many of them should result injuriously to the quality, but if buyers do not reveal this fact to him by refusing to pay the same price for them, who has the right to complain that he remains blind to it?

Moreover, it is the natural right of a producer to get all he can for his productions regardless of the cost of production, and we may be sure that he always will do so. Prices of all commodities are regulated by supply and demand, and only indirectly and irregularly by cost of production. The natural and rightful profit of the manufacturer lies in the margin between the market value of the product and the cost of production, which it is his business to make as large as possible, and which he can increase either (1) by improving the quality of his product or (2) by cheapening his process. All reputable manufacturers prefer the former to the latter method of reaping a profit when they have fair choice; but when the negligence of buyers as to quality destroys the proper market advantage from superior quality, the manufacturer has but one resource for enlarging his profits, which he is naturally always struggling to do—to cheapen his product regardless of quality.

It is therefore a practical necessity that the old legal maxim, *caveat emptor*, let the buyer look out for himself, should always remain the law of business life. On the other hand, the consumer has no further interest either in the cost or the manner of production than to buy *the article he really wants* as cheap as possible. It is only when he seeks cheapness regardless of quality that his conduct becomes injurious, and then the injury consists, not in too much anxiety to buy cheap, but in too little anxiety to get a good article, a view which does not seem to strike some manufacturers so forcibly as the moral duty aforesaid of paying high prices and leaving it to manufacturers to look after quality.

In the neglect of this natural relationship of buyer and seller we have the open secret of the degeneration in quality of steel rails which has undoubtedly taken place. *It has ceased to pay* to make efforts to improve or even maintain quality, because buyers do not demand and enforce good quality. Consequently the effort is very generally neglected. We might adduce a remarkable evidence of the natural result of such negligence in the rail specification of a leading railroad company, which was left purposely vague at the request of the rail-makers, not because they were unwilling or unable to furnish what was wanted to those who knew what was wanted and would have it, but because they objected to having a weapon furnished to those people who neither knew what they wanted nor knew how to get it, which might prove annoying and impede sales.

We may perhaps properly quote from the letter before us, which we cannot publish in full, the exact words in which this is expressed:

> We have gotten up one or two other specifications which would entirely satisfy our company, but our great trouble is that while the —— railroad company could get this material made in any shape they wanted it by paying a reasonable price for it, a great many railroads, in the South and West particularly, in ordering rails, specify "—— Railroad specifications." Therefore, while we are making specifications for ourselves, we are also making them for about two-thirds of the rail product south and west of ——, which you can see becomes a very serious question with the rail-makers.

When this sort of thing has been going on long enough, even the knowledge how to make really good rails may be expected to gradually die out, and we apprehend that to some extent it has. For example, the makers of the rails whose badness originated this discussion declared, and we understand still do declare, that they really do not know what the trouble is nor how to correct it. It is reasonable to believe that in confessing this they state the exact truth, nor is there anything in the fact really discreditable to them, but rather to their customers; for a manufacturer, like the rest of mankind, can only gain knowledge by experience, and can only gain experience in the manufacture of such articles as he produces, while he only produces such as are necessary to fulfill the public demands. Buyers have demanded rails exteriorly perfect, and they get them; they have demanded cheap rails, and they get them; they have in effect (unhappily) demanded soft rails, and they get them. They have *not* demanded, in any effectual way, those interior qualities which make for durability, and what can be more natural than that they do not get them? Manufacturers will find a way, we may be sure, to supply any quality needed to make their manufactures salable, and perhaps at no increase of cost, but so long as they sell, they will naturally take only the vaguest interest in their other defects. Regard for their future reputation, no doubt, has its influence, but it is a weakness of our poor human nature, if the present is going along smoothly, to let the future take care of itself. Moreover, the saving principle of competition is prevented by the peculiar conditions from having full play.

That any specific physical quality desired will be obtained readily enough by stating precisely what it is, seems to be indicated by the very difficulty complained of from over-soft rails, which may fairly be supposed to have arisen largely from over-attention to a supposed demand of the railroads for "soft" rails, a demand which, in its most formal expression, was certainly unfortunately expressed and possibly in part a mistaken one, but which could have done no great harm if the expressed condition that "the limit of softness should be such that the rails will retain their form" had been attended to by the buyers.

The natural remedy for the existing difficulty would seem to lie, therefore, solely in proper tests for physical qualities. Abundant standards for tests of this kind already exist. We imagine, however, that, however it may have been five or ten years ago, there is now room for some useful work in determining other and new tests, simpler to make, easier to interpret, and having a more direct relation to the qualities really required; something on the principle of the test for stay-bolt iron in use on the New York, Lake Erie & Western Railroad, described in our issue of May 15, in which it was found that fixing a piece of the iron to be tested in a vise and subjecting it to similar bending strains to those of actual service afforded a more satisfactory indication of quality, for that particular use, than all the more elaborate tests for tensile strength, elongation, limit of elasticity, etc., which require an expert both to make and to interpret.

Similarly with rails, it seems reasonable to believe that information now exists for determining some simple tests which will, at least, be better than none, and perhaps better than the far more elaborate tests which have no direct relation to the service required. There are on every large road many brands or single rails known to be good and many others known to be poor. The poor rails, perhaps, crush under the impacts of service and the good rails do not. It is a matter which does not admit of doubt that, if we place samples of such rails on a firm support and drop known weights through known heights upon them, the heads of the poor rails will be distorted under the impacts much sooner than those of the good rails, and that a point of distortion under impact can be readily determined, which will indicate with sufficient precision whether or not a given rail is too soft for good service.

So with durability. If some specimens of rails known to be high and low in this quality be selected, and one or more pieces of each be placed, say, on the bed of a shaping machine, over which another piece of the same rail of known weight is made to slide a certain number of thousand times with a certain number of inches throw, it is altogether probable that a noticeable difference in the rate of abrasion would be detected, quite sufficient to draw a reasonable line between fairly good and bad rails, notwithstanding that the conditions are not precisely parallel to those of actual service.

Experience already gained seems to indicate that bending tests also are among the most satisfactory and reliable indications of quality. No one test, however, can reasonably be expected to prove entirely satisfactory, and in the making of all tests great care is necessary, and some contradictory results must be expected; but that it is possible to determine and formulate tests which can be made with little labor and without elaborate special apparatus or much technical training can hardly be doubted. He who shall determine them will do a needed work.

THE NATIONAL EXPORTS AND IMPORTS.

The statement of values of imports and exports for the fiscal year shows a slight increase over 1883–84 in the domestic exports, and a decrease of 90 million dollars (13½ per cent.) in the imports. The excess of exports (of domestic and foreign goods) over imports was $164,400,000, which is the greatest excess since 1880–81, but is less than in any of the four previous years.

In the 14 years from 1860 to 1873 inclusive, there was but one year (1861–62, the first of the war) when the imports did not exceed the exports. In 1873–74 the exports were larger by $18,876,700, but the next year the imports were larger by about the same amount, and for the 16 years ending with 1874–75, the aggregates were:

	Av. per year.	Total.
Domestic exports	$321,021,827	$5,136,349,230
Foreign exports	15,605,898	249,694,363
Total exports	$336,627,725	$5,386,043,593
Imports	410,103,322	6,561,653,154
Excess of imports	$73,475,598	$1,175,609,561

The excess of imports was largest in 1872, and next to that in 1864, but it averaged about $78,778,000 a year in the last eight years, against $68,173,000 in the first eight.

Since 1874–75 there has been an excess of exports every year, varying from 26 millions in 1881–82, after the bad crops, to 264¾ millions in 1878–79, and 259¾ millions in 1878 and 1881. In the four years from 1878 to 1881 inclusive, the average excess was 237½ millions; in the four years following, 91 millions—a very important decrease.

The aggregates and averages for the ten years since 1875 have been:

	Av. per year.	Total.
Domestic exports	$719,109,976	$7,191,099,761
Foreign exports	15,187,029	151,870,292
Total exports	$734,297,005	$7,342,970,053
Imports	579,850,803	5,798,508,028
Excess of exports	$154,446,202	$1,544,462,025

The aggregate domestic exports for the last 10 years are 40 per cent. more than the aggregate for the 16 years previous, but the aggregate imports for the last eight years are 11½ per cent. *less* than the aggregate for the 16 years previous. The *average* of 321 millions of exports from 1860 to 1875 rose to 719 millions from 1876 to 1885; and the average of 416½ millions of imports in the first period rose to 580 in the last.

The recent course of the exports and imports is given below, in *millions* of dollars:

	Exports.				
Year.	Domestic.	Foreign.	Total.	Imports.	Excess of
1870	376.6	16.2	392.8	436.0	Imp. 43.2
1871	428.4	14.4	442.8	520.2	" 77.4
1872	428.5	15.7	444.2	626.6	" 182.4
1873	505 0	17.4	522.4	642.1	" 119.7
1874	569.4	16.9	586.3	567.4	Exp. 18.9
1875	499.3	14.1	513.4	533.0	Imp. 19.6
1876	525.6	14.8	540.4	460.7	Exp. 79.7
1877	589 7	12.8	602.5	451.3	" 151.2
1878	680.7	14.2	694.9	431.1	" 257.8
1879	698.3	12.1	710.4	445.8	" 264.6
1880	823.9	11.7	835.6	667.9	" 167.7
1881	883.9	18.5	902.4	642.7	" 259.7
1882	733.2	17.3	750.5	724.6	" 25.9
1883	804.2	19.6	823.8	723.2	" 100.6
1884	725.0	15.5	740 5	667.7	" 72.8
1885	726.5	15.4	741 9	577.5	" 164.4

There was but little interruption to the growth of the domestic exports until after 1880–81, but the reduction was great then, and last year these exports remained 157 millions (18 per cent.) less than 1880–81. The imports have fluctuated much more. Having increased nearly one-half from 1870 to 1874, they decreased then steadily until after 1878, when they were nearly one-third less than in 1874, and about the same as in 1870. Then they increased 55 per cent. in two years, but reached their maximum the year after the maximum exports, when they were 68 per cent. more than in 1878. Since 1882 they have decreased every year, and last year were 20 per cent. less than in 1882.

The course after 1873 was, generally, an increase in exports together with a decrease in imports, until prosperity returned after 1879. We may take 1880–81 as the culmination of the late period of prosperity, since which we have had a reduction of imports similar to but less in proportion than that after 1874 (20 per cent. in three years, against 28 per cent.), but we have had no increase in exports; on the contrary, there has been a decrease in them even greater than the decrease in imports.

In considering these figures we should always bear in mind that this country has increased greatly in population as well as in commerce since 1870. Below we give the exports and imports *per inhabitant*, in different years:

	1870.	1873.	1878.	1880.	1881.	1883.	1885.
Domestic exp'ts	$9.77	$11.99	$14 32	$16.43	$17.05	$14.54	$12.43
Total exports	10.19	12.40	14 61	16.66	17.41	14.89	12.68
Imports	11.31	15.23	8.07	13.31	12.40	13.07	9.88

Thus the exports per inhabitant have decreased 27 per cent. since 1881, yet were larger last year than in 1873 (slightly less than in 1874), while the imports per inhabitant have decreased 20 per cent. since 1881 and 24½ per cent. since 1883, and are smaller than in any other year given except 1878.

Movement of the New Wheat Crop.

The new wheat crop is very slightly felt as yet, and only in the receipts of St. Louis, Toledo and Baltimore, and much less than usual at this season there. Ordinarily the wheat receipts of the Northwestern markets begin to increase shortly after the wheat harvest in the Ohio Valley is completed, as shown below, where the average weekly receipts in June are compared with those of the July weeks:

Per week in	1881.	1882.	1883.	1884.	1885.
June	1,562,112	627,578	857,966	781,492	1,146,581
Week to—					
July 4	1,044,166	848,580	445,595	604,167	1,091,303
" 11	1,135,421	1,595,224	462,883	757,021	925,408
" 18	1,198,660	3,161,184	613,570	988,743	882,009
" 25	1,711,001	3,986,077	938,932	1,385,641	1,133,400
Aug. 1	1,767,390	3,459,361	1,546,574	2,112,715	1,379,572
" 8	1,286,067	1,809,241	2,232,644	2,586,210	.....
" 15	1,640,244	2,106,606	2,606,417	4,697,606	.....

In years when the winter wheat crop is abundant and *early*, the receipts usually increase largely as early as the second week of July, as in 1882, when the receipts of the week to July 11 were 2½ times as great as the average weekly receipts in June, and when they reached a maximum more than *six times* as great as the June average in the fourth week of July. Even in 1881, when the wheat crop was a failure, the receipts largely increased after the middle of July. In 1883, with a poor crop, the marked increase came in the last week of July, when the receipts were 80 per cent. more than the June average. Last year, with an enormous crop, but also a large surplus from the old crop, the receipts of the week to July 25 were 207,000 bushels (26 per cent.), and those of the next week 604,000 bushels (77 per cent.) more than the June average.

Now, this year the *winter wheat* crop—which alone is marketable as yet—is miserable, and the Northwestern wheat receipts of the week to July 25 were not quite equal to June average, before there was any new wheat to ship, and in the week to Aug. 1 they were but 233,000 bushels (20 per cent.) above that average.

The receipts increase first at St. Louis, then at Toledo, and a little later at Chicago.

For three years the receipts at these places and at Milwaukee, and the total of the eight reporting Northwestern markets in successive weeks, have been:

1883: Week to—	Chicago.	Milwaukee.	Toledo.	St. Louis.	Total N. W.
July 7	114,703	86,624	93,144	66,407	445,595
" 14	126,767	60,985	74,829	110,957	462,883
" 21	124.436	94,578	44.979	298,146	613.570
" 28	127,760	80,230	133,702	540,946	938,932
Aug. 4	249,336	75.391	411.136	704,691	1,546.574
" 11	353,713	76.907	398,474	755,156	2,232.644
" 18	331,704	68,998	1,096,571	806,040	2,666.417
1884: Week to—					
July 5	71,424	256.405	77,159	86,480	604.167
" 12	96,893	268,820	65,864	280,891	757,021
" 19	97,626	183,753	74,786	491.189	988,743
" 26	147,496	264,804	325.155	480,771	1.385,641
Aug. 2	287,077	87,152	682,199	764,896	2,112,715
" 9	568,334	78.887	733,632	799,862	2,586.210
" 16	1,297,780	72,085	888,336	973,421	4,697,606
1885: Week to—					
July 4	190,526	183,574	49,903	89,860	794,996
" 11	321,486	162.779	61,009	126,685	925,408
" 18	284,204	138.514	32,080	161,967	882,009
" 25	264 311	124,700	70,913	318,837	1.133,400
Aug. 1	215,508	104,498	258,556	373,000	1,379,572

At St. Louis a marked increase began in the third week of July in 1883, in the second week in 1884, and in the third week this year. At Toledo the large receipts began two weeks later in all these years, and at Chicago three weeks later in 1883 and 1884. But the figures are notably less this year at St. Louis and Toledo than in either of the two previous years, indicating the lightness of the crop. Last year in the last week of July Toledo received 2½ times as much and St. Louis twice as much in the last week of July as they did this year.

The receipts at Chicago from the *winter* wheat crop do not usually make much of a figure until the first or second week of August, and this year they are not likely to make much of a figure at any time, because there is not much in the country which supplies it. Detroit will do better getting the good Michigan crops, but before the end of August Chicago's receipts are usually swelled by the shipments of Nebraska and Iowa *spring* wheat, while at Milwaukee, which receives from territory further north, receipts do not usually increase until September, and do not reach their maximum until October or even later (last year in December).

Baltimore begins to receive new wheat quite as early as St. Louis. Last year, after an average of 249,000 bushels a week in June, it received:

Week ending— July 5.	July 12.	July 19.	July 26.	Aug. 2.
236,443	405,774	437,921	1,003,280	1,411,148

The last week in July was the maximum. The average in August was not more than half as great. This year the average receipts of wheat at Baltimore in June were 131,401 bushels per week, and since then have been:

Week ending— July 4.	July 11.	July 18.	July 25.	Aug. 1.
66,199	144,142	332,267	435,400	429,423

The maximum here is not one-third of the maximum in 1884, and its aggregate receipts for the five weeks, which were 3,496,866 bushels last year, were but 1,407 431 this year.

This leads to the consideration that the railroads which will suffer most from the bad winter wheat crop this year are those in the winter wheat territory that has suffered—Ohio, Indiana, the southern two-thirds of Illinois, Missouri and Kansas, and those which carry from this territory chiefly. In the west, this includes the lines south of the Chicago, Burlington & Quincy and the Rock Island (which themselves will suffer from the smaller through shipments from Kansas), and south of the Lake Shore. The lines which have the largest share of the shipments to the East are probably the Pittsburgh, Cincinnati & St. Louis and connections and the Baltimore & Ohio. These, however, and all the other roads are likely to have an unusually large amount of corn to carry. There are no short crops directly west of Chicago and further north, though the spring wheat is generally not quite as good as last year. Among the lines likely to have the largest falling off in wheat shipments are several of those which have had the most serious decline in earnings since 1883.

Railroads in China & Japan.

The long predicted beginning of railroad construction in China seems to have begun, if we may believe the reports which are made with some appearance of authenticity, that a *bona fide* contract has been entered into with the sanction and under the authority of the powers that be in China for the construction of about 120 miles of line to connect the capital, Pekin, with its seaport at the mouth of the Peiho River. The recent Chinese loans floated in London are supposed to be intended largely for railroad uses. Too much hope that the line will be carried through should not be indulged in, however, on the mere strength of the fact that a contract has been entered into, for there will undoubtedly be a powerful opposition to the enterprise which may at any time bring about a reversal of the policy of the government, much as with the little 9½-mile road from Shanghai to Woosung built some nine years ago, which was first tolerated and then bought out and destroyed by the Chinese government soon after completion. The government, it is true, was far less committed to countenancing or even tolerating that enterprise than it is, if all reports are true, to this new one, and the fact that the road is to be built (if it is built) from the capital to its seaport is alone significant as indicating that railroads are no longer looked on as doubtful and dangerous experiments, to be kept at arm's length so far as possible.

There has been talk from time to time before this of the building of lines in China as an experiment, on the island of Formosa and elsewhere. In fact, shortly after the untimely end of the first Chinese line, an American interest in China thought they had got so near to closing a contract with the Government as to have engineers all engaged to sail on telegraphic orders, but the project fell through, as did also a later one, of both of which we were cognizant at the time, although no public mention was made of them in our columns or (so far as we know) elsewhere.

At present, the contest appears to be, so far as appears on the surface, between the Germans and English, with the odds, as well as "first blood," decidedly in favor of the English. Americans, however, should make an effort to do their full share in building the immense railroad mileage which may some day be reasonably expected in China. We can give them cheap and efficient railroads, and probably can spare some capital for them, as well as a large force of skillful engineers and some material, to the advantage of China and ourselves.

The Japanese have done far better. They have shown in railroad building as in other matters that they are a more progressive people than the Chinese, and have already a considerable mileage, some 240 miles; yet the comparative slowness with which their railroad system grows seems to make the outlook less rather than more favorable for the speedy beginning of a railroad-building era in China. The first Japanese line, 20 miles long, built to connect the capital and its seaport, like the first projected Chinese line, was opened in 1872, and cost $150,000 per mile over a perfectly flat country. In 1874 60 miles more of line were opened, costing $7,000,000, or $117,000 per mile. Both these lines were built by English engineers, as an American would be inclined to suspect from their cost. No further mileage was opened until eight years later, 1882, when 27 miles were completed. In

the following year 62 miles more were opened, and in the present year 57 miles more, making a total of 2,260 miles, to which should be added 14 miles more of miscellaneous mileage. In this latter mileage American engineers have had a hand, but we have no data at hand as to their cost.

It is said with some appearance of authority that five other lines are "about to be commenced;" one 450 miles long, running the entire length of the main island of Niphon, two others 150 and 200 miles respectively, and two other short local lines. If all these reports are true, they indicate that a true railroad-building era has set in in Japan, but they may be taken with some grains of allowance, especially as Japan is now suffering from great industrial prostration, having apparently gone too fast, for a time, in some of its many industrial changes. True or false, however, the Japanese have taken at least 13 years after their first experience of the blessings of railroads to get ready to go into them on any considerable scale, and the Chinese may naturally be expected to take at least twice as long. Americans, therefore, have still a chance if 26 years' notice is enough for them, as it generally is.

We have this week reports of July earnings from 29 railroads, whose aggregate earnings were:

	1885.	1884.	Decrease.	P.c.
Earnings	$16,219,110	$16,257,974	$38,864	0.2

That is, these companies taken together earned just about as much this year as last in July. July last year was less unfavorable than June, though the earnings per mile of the 74 railroads reporting were 7½ per cent. less in 1884 than in 1883. The result this year so far is comparatively favorable. Of the 29 railroads, no less than 18 show an increase in total earnings, and no company but the Canadian Pacific has a large increase in mileage this year, and this is partly offset by the large decrease of the Wabash. There are few large increases or decreases except by these two roads, but the Denver & Rio Grande gained 37 per cent., the Denver & Rio Grande Western 97 per cent. (yet earned but $242 per mile), the Oregon Railway & Navigation Company 24½ per cent., and the St. Paul & Duluth 18½ per cent. The larger decreases are 18½ per cent. by the Cincinnati, Indianapolis, St. Louis & Chicago, 15½ on the Memphis & Charleston and 13½ by the Grand Trunk. Last week we gave the total earnings in July for five years for six of the more important railroads. Below a similar statement is made for others:

	1881.	1882.	1883.	1884.	1885.
Chic. & Alton.....	$676,205	$702,635	$731,503	$724,619	$7 7,291
Cin., Ind., St. L. & C.	177,161	217,198	190,128	209,515	170 922
Det., L. & Nor.....	112,707	122,894	121,255	97,903	92,037
Flint & P. M.....	137,514	148,503	184,427	171,248	151,469
Ill. Central:					
Ill. & So. Div.....	748,805	837,981	772,792	704,232	723,777
Iowa lines	171,685	140,052	154,678	127,718	129,577
K. C., Ft. S. & G.....	122,394	135,937	142,135	176,230	172,438
Louisville & N.....	817,135	1,063,705	1,124,776	1,154,109	1,051,335
Mobile & Ohio.....	135,548	135,174	134,464	129,323	118,293
Norfolk & W.....	173,374	191,535	210,188	177,902	187,397
Rich. & Dan.....	244,380	272,282	250,923	250,923	269,000
St. P. & Duluth.....	71,412	96,619	137,924	119,500	141.855
St. P., M. & M.....	387,488	853,296	612,706	605,156	553,347
Wis. Cen.....	77,805	79,358	108,159	107,791	11-,565

Of these 14 roads five earned more this year than last, and four more than in 1883, but there are many large decreases since the latter year, as 15 per cent. by the Lansing road, 18 by the Pere Marquette, 16 by the Iowa lines of the Illinois Central, and 15 by the Norfolk & Western. The Cincinnati & Indianapolis earned less than in any other year of the five, as did the Lansing & Northern and the Mobile & Ohio. The Manitoba earned 8½ per cent. less than last year, 9⅞ per cent. less than in 1883, and 35 per cent. less than in 1882, when its mileage was nearly a third less, but when it was reaping a harvest from the Manitoba "boom" and from the carriage of all the material for the Canadian Pacific. Its earnings per mile in July were $322 this year, against $853 in 1882. July and August are usually dull months for this road. The St. Paul & Duluth and the Wisconsin Central earned more this year than in any previous July.

The New York Central report for the quarter ending with June shows a profit of only 27 cents per share, and that notwithstanding a decrease in working expenses exceeding by one-half the reported profit. The figures for the quarter and for the nine months ending with June for the last two years are:

	Quarter.		Nine months.	
	1885.	1884.	1885.	1884.
Gross earn...	$5,603,634.06	$6,361,070.62	$18,376,026.01	$20,985,790.15
Expenses*....	3,878,863.54	4,232,257.65	11,819,165 20	13,132,950.02
Net earn....	$1,724,770.52	$2,128,812.97	$6,556,860 81	$7,852,840.13
Fixed char.†..	1,485,000.00	1,395,000.00	4,470,000.00	4,185,000.00
Profit.....	$239,770 52	$733,812.97	2,086,860.81	3,667,840.13
Dividend	447,141.50	1,788,566.00	2,682,849.00	5,365,698.00
Deficiency..	$207,370.98	$1,054,753.03	$595,988 19	$1,697,857.87
Per cent.:	1885.	1884.	1885.	1884
Expenses	69.22	66.53	64.32	62.58
Profit.....	0 27	0 82	2.33	4.11
Dividend	0.50	2.00	3.00	6.00

* Including taxes on property.
† Including state taxes on capital and earnings.

Last year both gross earnings and working expenses were swelled by the inclusion of the amounts raised and paid for car mileage, while this year only th debit balance is given. This, however, makes no difference with the net earnings.

We see for the quarter the following decreases:

	Gross earnings.	Expenses.	Net earnings.	Profit.
Amount	$757,437	$353,394	$404,043	$494,239
Per cent.....	11.9	8.3	19.0	67.4

That the profits were reduced two-thirds when the net earnings were reduced less than one-fifth is due to an increase in the fixed charges. The profit per share fell from 82 cents last year to 27 this. But the quarter was exceptionally unfavorable last year, and the full amount of the loss is not seen by a comparison with that. The only others reported were in 1879 and 1880, and then only the gross earnings. In these and the last ten years they have been:

1879.	1880.	1884.	1885.
$6,448,459	$7,976,798	$6,361,071	$5,603,634

This year they are no less than 30 per cent. less than in 1880.

For the nine months ending with June the gross earnings have been:

1878-79.	1879-80.	1883-84.	1884-85.
$20,733,756	$24,289,115	$20,985,790	$18,376,026

The decrease from last year is $2,609,764 (12½ per cent.), and from 1880 it is $5,913,018, or 24 per cent. In 1879 the earnings of these nine months were 76.5 per cent. of the earnings of the year; in 1880, 73¼ per cent.; in 1884, 74⅔ per cent. At the lowest of these rates the New York Central will earn during this year about $25,000,000.

The profits after paying fixed charges amount to $2.33 per share this year, against $4.11 last year. The profits per share for the entire year have been:

1878.	1879.	1880.	1881.	1882.	1883.	1884.
$8.98	$8.49	$11.82	$8.82	$6.42	$8.19	$5.22

Should the current quarter yield proportionally as much as the last quarter of last year, the profits will be 63 cents per share, and for the whole of this year ending with September they will be $2.96 per share.

In both years the dividends have been greatly in excess of the profits, last year $6 being paid for the three quarters, against $4.11 earned; this year $3, against $2.33 earned.

German Compound Locomotives.

From an article in a recent number of *Glaser's Annalen* (Berlin), we prepare the following account of the compound locomotive designed by Master Mechanic von Borries, the first of which went into operation in 1880, and 18 of which are now in operation on the Hanoverian railroads, with, it is said, entire satisfaction, while a number are being built.

These engines are very similar in construction to the ordinary German outside-connected engines, the cylinders having apparently the same diameter outside the lagging—neither cylinder being steam-jacketed, however, as Herr von Borries thinks the extra expense unprofitable.

The advantage of compound working may be stated as follows: In the ordinary locomotive with slide valves and narrow ports, it is not very desirable to attempt more than three to four-fold expansion, and the steam is passed off at a pretty high temperature, which is utilized somewhat in the second cylinder of the compound machine. Furthermore, the shell of the cylinder naturally takes the mean temperature of the steam passing through it, and as the temperature of the expanded steam falls below this, it absorbs, before passing into the stack, a certain amount of heat from the cylinder shell, which has to be replaced from the entering steam. This operation in a compound machine takes place in the low-pressure cylinder only, since the heat absorbed by the steam from the other cylinder is utilized in the low-pressure one. The steam lost in the clearance spaces and in the leakage around the piston of the high-pressure cylinder is also utilized, and a more uniform pressure on the piston is attained for the same degree of expansion.

With steam cut off at one-quarter stroke, the greatest force of the steam is exerted where it is least effective and produces most friction, while if we get the same expansion by cutting off at one-half and expanding into another cylinder, the action of the steam is obviously more effective.

By the possibility of expanding two-fold while giving full steam to one cylinder, and attaining an eight-fold expansion by cutting off at one-fourth, greater and more profitable range is given to the engineman in graduating his cut-off.

With all these theoretical advantages, a practical average saving of fuel of 17.1 per cent. over locomotives of similar construction with ordinary cylinders has been attained. This result is the average of the collective working of three compound engines—respectively freight, passenger and omnibus engines—working against seven different ordinary engines of similar class and weight for periods of from three to nine months each.

The boiler pressure carried on the compounds was 180 lbs., while that of the other engines varied with the different machines tried from 135 to 180 lbs.

The valve gear of these compound engines is just as simple as that of ordinary engines, the links for both cylinders being set by the same movement of the lever and not capable of separate adjustment.

It is to be noted that in this system both slides receive together the pressure usually thrown upon one for a given quantity of steam used, causing less wear on the parts.

Since the pressure on the pistons is more uniform throughout the stroke, and since the work is more equally divided between the pistons, these engines run very steadily; and this, with the smaller quantity of fuel burned, makes the repairs for machinery and boiler less than usual, in spite of the high boiler pressure carried.

The high expansion of the steam diminishes the intensity of the blast so much as to cause little or no spark-throwing from the stack.

To ascertain the necessary diameter d of the large cylinder Herr von Borries uses the following formula:

$$d^2 = \frac{2\,Z\,D}{p\,h}$$

Where Z = tractive force required = 0.14 to 0.16 of the adhesion weight (when allowance is made in Z for the external engine friction, taken as equal to that of the cars).

D = driving-wheel diameter (inches).

h = stroke (inches).

p = mean effective steam pressure (after deducting internal machine friction) per square inch.

This latter depends upon the comparative cross-sections of the two cylinders, and from experience and indicator experiments may be taken as follows:

	Relative section of cylinders.	p in per cent. of boiler pressure.	p for 180 lbs. in boiler.
Large engines with tenders.....	1:2	0.45	81.0 lbs.
Tank engines.....	{1:2.25 / 1:2.3}	0.42	75.6 "

Engines for long, heavy grades should be proportioned for $Z = 0.16$ adhesion weight, that they may have large enough cylinders; but 0.14 is usually enough.

For passenger and express engines the size of the small cylinder may be made on the usual basis, and the large cylinder of double the section, and the boiler pressure increased 15 to 30 lbs.

It is desirable in general to proportion these engines so that they may ordinarily work at one-fourth to one-third cut-off.

A compound engine of this kind will pull, according to Herr von Borries, 10 to 15 per cent. more than an ordinary machine with the same heating surface and grate area.

The receiver between the cylinders is best constituted by a pipe passing, if possible, through the smoke-box, and if not over the boiler, lying close to it, and well protected from cooling off. The cubic content of this connection pipe should not be less than that of the small cylinder, and it is better larger, in order to avoid too unequal back-pressure on the small piston.

In order to give as much power as possible for starting, it is necessary to bring pressure at once on both pistons. For this purpose an ingenious stop-valve has been contrived by Herr von Borries. This valve is placed in the connection pipe between the cylinders, and when the throttle is first opened a small port gives entrance to steam behind the valve and holds it to a seat over the exhaust from the small cylinder, and allows the pressure from the boiler, reduced however by the small area of the port, to take effect on the large piston. As soon as the exhaust port of the small cylinder opens, the steam from this overpowers the pressure behind the stop valve and forces it back to a seat closing the small extra port above referred to. This port is then kept closed by the boiler pressure itself acting on a balancing device until opened by the driver by means of a special lever.

Before opening the throttle, therefore, the engineer throws this lever over, and the opening of the throttle lets boiler steam into both cylinders, which access is suspended automatically as soon as the exhaust of the small cylinder opens.

The steam from the stacks of these engines is somewhat damp. This is not a sign of foaming, but an indication of the more perfect extraction of the heat and power from the steam.

The steam production by these engines, particularly in fast running, is especially good; evidenced by the fact that the opening of the exhaust nozzles can be made ⅜ to $\frac{5}{16}$ in. wider than is usual, which is attributed to the much more uniform quality of the blast with its low pressure and two gentle impulses instead of four violent ones in every revolution.

Herr von Borries sums up the chief advantages of the compound engine very sensibly as follows: Better production of steam through more uniform blast, and better application of it through higher expansion and the possibility of getting a good expansion with very high pressure steam, without unduly increasing the friction.

From the uniformly good results attained by the three different methods of Mellet in France, Webb in England, and Von Borries in Germany, and similarly good results by Worssdell in England, with an arrangement similar to Von Borries', it would seem as if the failure of the system to work on the Boston & Albany must be due to an unsatisfactory application.

The adverse experience with compound locomotives on the Kaiser Ferdinand Northern Railroad of Austria, which by its own account lay entirely in the heavy repairs, seems to have been due to their injudicious use of the Mallet system. In this there are two sets of valve gear, to permit working either simple or compound; and the road in question found that in working high-pressure on both cylinders the unequal pressure racked the engine frame and working parts out of order.

This high-pressure working, according to Herr von Borries' experience, is only necessary on the starting stroke, and he gets over the unequal pressure by contracting the throttles to the low-pressure cylinder.

Chicago through shipments eastward for the week ending Aug. 8 show a great recovery over the exceptionally ligh-

Fig. 1.

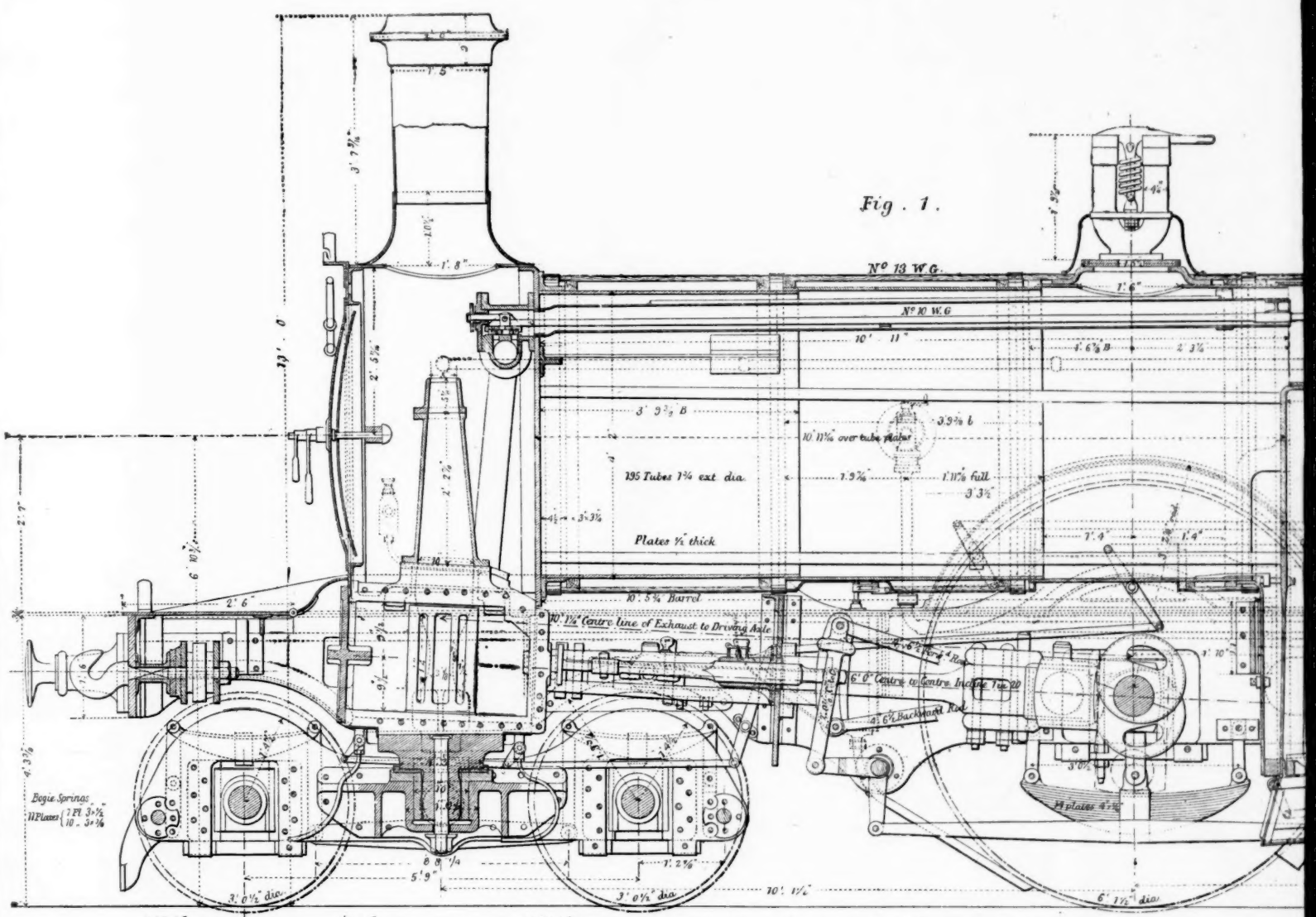

N° 13 W.G.
N° 10 W.G.
195 Tubes 1¾ ext. dia.
Plates ½" thick
10' 5¾ Barrel
10' 1½" Centre line of Exhaust to Driving Axle
6' 0" Centre to Centre Inside Tire
Bogie Springs
11 Plates
5' 9"
3' 0½" dia.
70' 1½"
7' 6"
2' 10½"
7' 3"
26' 0" total length of Frame

Fig. 2.

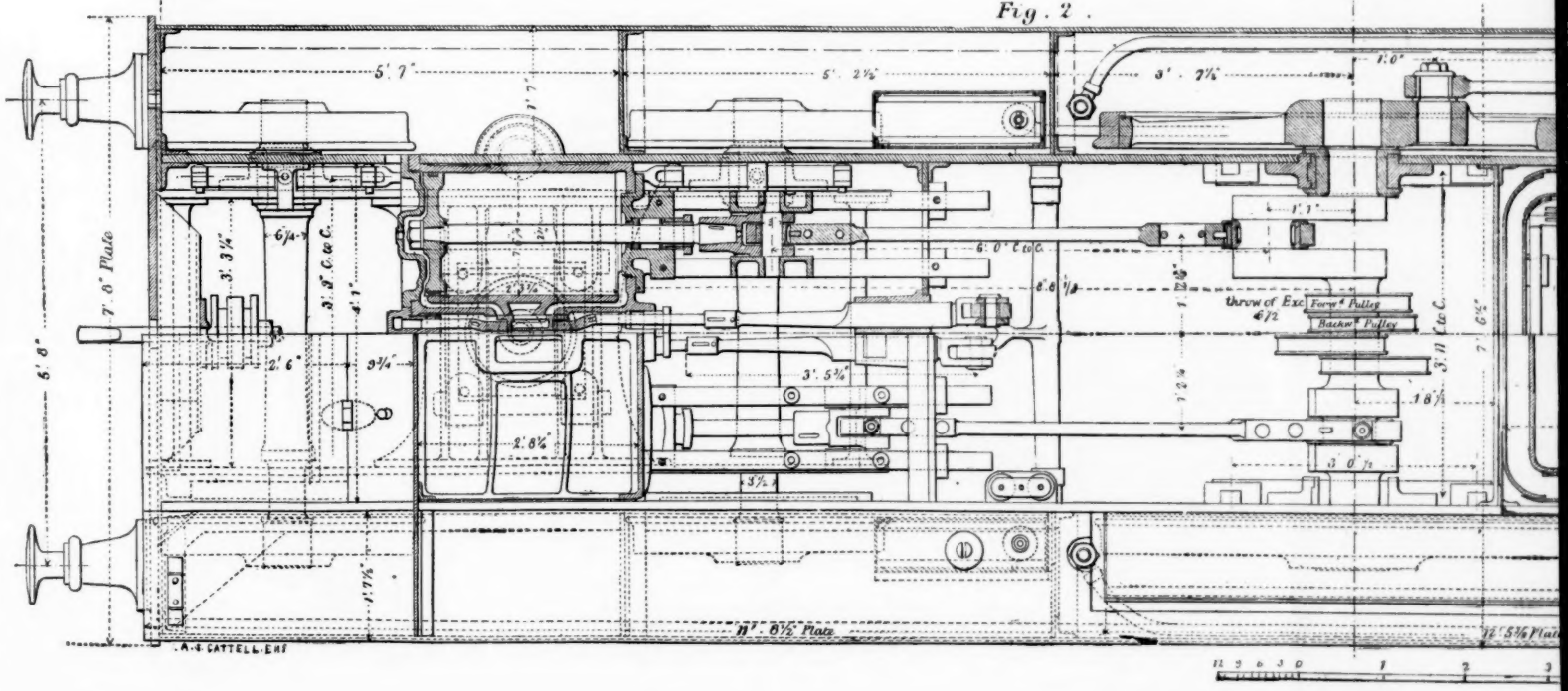
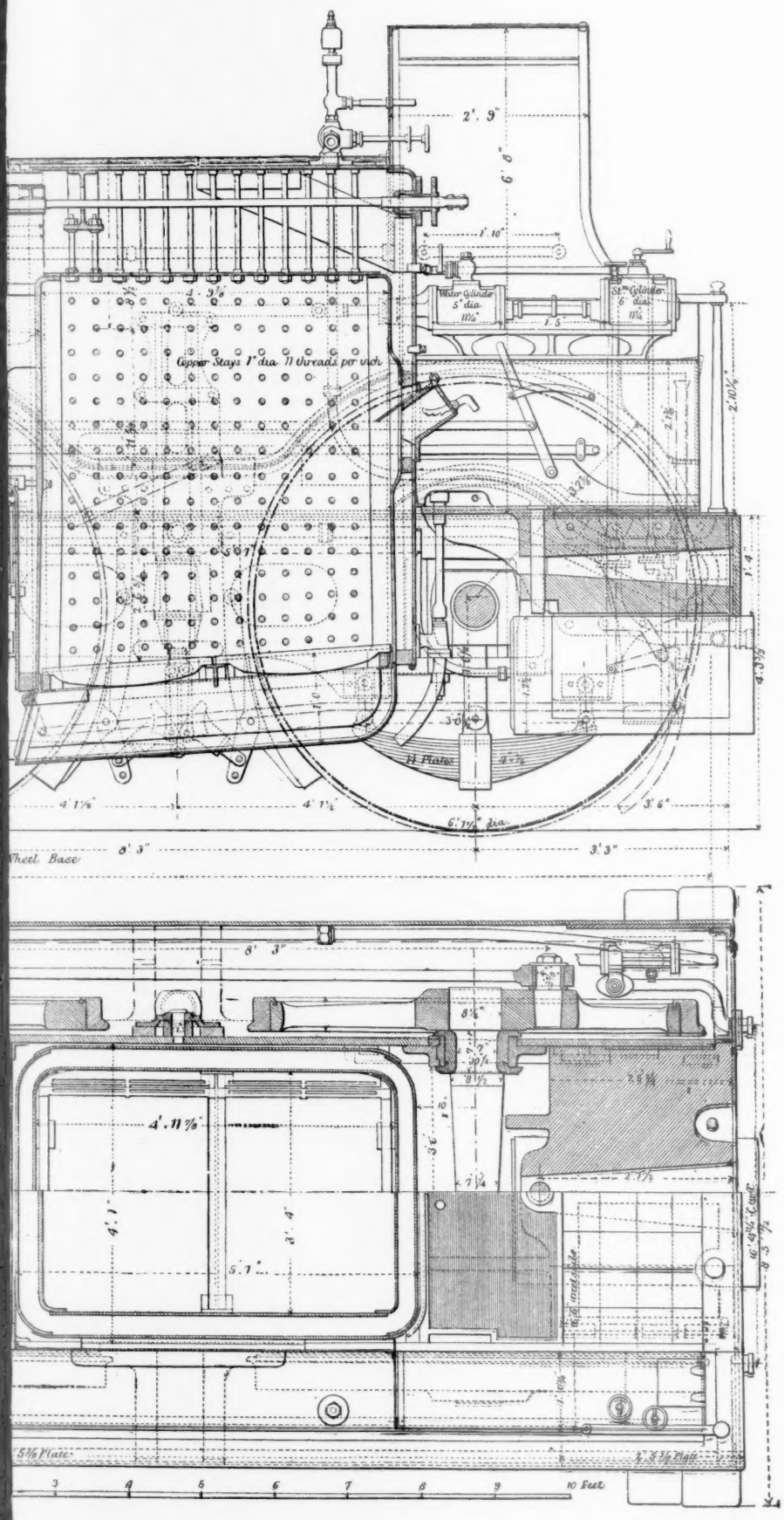
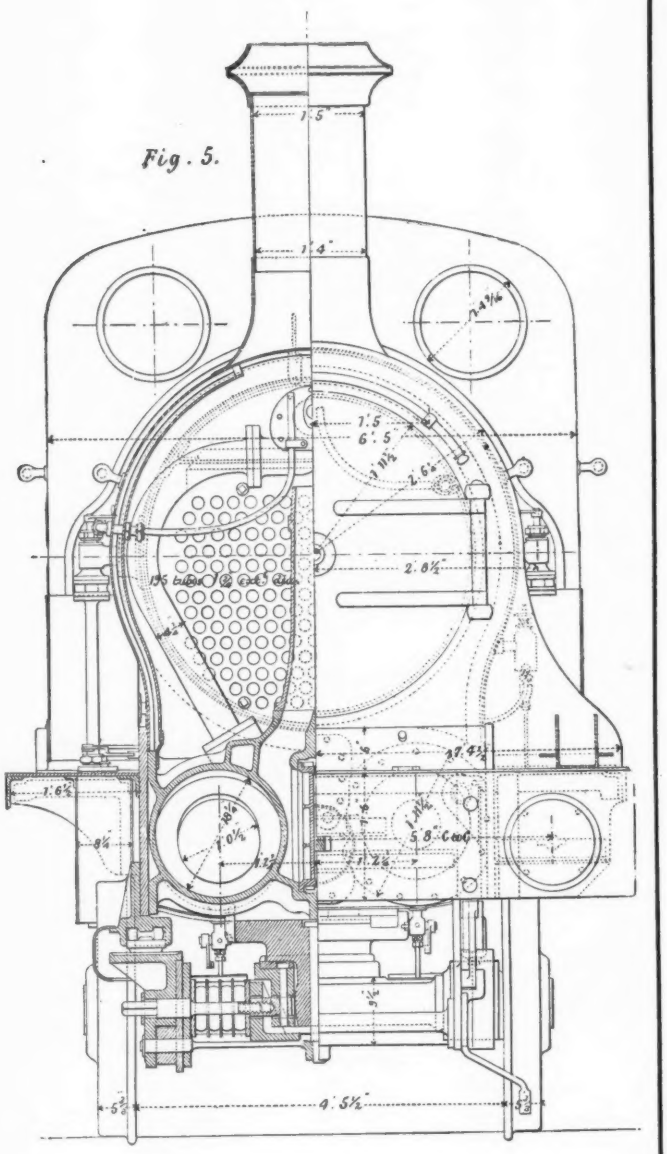

7' 6" Plate
5' 8"
5' 7"
5' 2½"
3' 7½"
6¼"
3' 3¼"
3' 3" C. to C.
2' 6"
9¾"
2' 6¼"
3' 5¾"
6' 0" C. to C.
Throw of Exc. 6½
Fore⁴ Pulley
Back⁴ Pulley
3' 11" C. to C.
7' 6½"
3' 0½"
11' 8½" Plate
A. G. CATTELL. ENG.

Fig. 5.





PASSENGER LOCOMOTIVE.

GLASGOW & SOUTHWESTERN RAILWAY, SCOTLAND.

(*For description see page* 513.)

shipments of the previous week. They were, compared with the shipments in corresponding weeks of previous years:

1880.	1881.	1882.	1883.	1884.	1885.
42,789	54,690	24,813	33,487	22,960	26,111

Thus, this year, the shipments were 15 per cent. more than last year and 5 per cent. more than in 1882, but less than in any other year of the six, and 39 per cent. less than in 1880, when the rates were 50 per cent. higher than now, and the traffic was divided among six instead of eight railroads.

In each of the last six weeks the total shipments and the percentage going by each railroad have been:

	Week ending July 4.	July 11.	July 18.	July 25.	Aug. 1.	Aug 8.
Tons:						
Flour	4,972	5,474	5,044	2,754	2,134	2,609
Grain	24,892	20,864	19,128	9,778	7,528	15,773
Provisions	8,949	7,584	8,219	8,011	7,828	7,729
Total	38,813	33,922	32,391	20,543	17,490	26,111
Per cent.:						
C. & Grand T.	9.5	10.8	11.9	14.3	15.1	12.4
Mich. Cen	21.0	17.4	17.4	8.8	8.2	32.7
Lake Shore	15.9	20.0	14.8	14.0	11.8	9.7
Nickel Plate	11.5	7.6	9.7	7.1	10.4	8.6
Ft. Wayne	19.9	16.0	19.0	23.7	23.7	16.8
C., St. L. & P.	6.0	7.8	7.5	12.3	13.1	9.6
Balt. & Ohio	9.1	8.6	10.1	8.1	9.2	5.9
Ch. & Atlantic	7.1	11.8	9.6	11.7	8.5	4.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

The total increase over the previous week being 8,621 tons (50 per cent.), there was an increase of 22 per cent. in flour, and of 8,245 tons (109½ per cent.) in grain, but a decrease of 99 tons in provisions.

The change in the percentages is great, the Michigan Central taking nearly four times the share it had then and six times the quantity. But this exceptionally large percentage is not enough to make good its very small percentage for two weeks previous: for the three weeks ending Aug. 8 the Michigan Central has carried but 18.3 per cent. of the total Chicago shipments, while its allotment in the last pool was 20 per cent. Its large share last year reduced the percentage of every other road, but affected most the two Pennsylvania roads, the Baltimore & Ohio and the Chicago & Atlantic. The two Pennsylvania roads carried 49 per cent. of the provisions, and the Chicago & Grand Trunk 18¾ per cent.; no other roads as much as 11 per cent. On the other hand, the Michigan Central carried 46¾ per cent. of the grain. There are conflicting reports as to the maintenance of rates, the most trustworthy being that they are pretty firm at Chicago, but cut at Peoria and St. Louis.

The passenger earnings of the Chicago, Burlington & Quincy Railroad, which in the first four months of this year were considerably ($151,323 = 9½ per cent.) less than last year, in the next two months (May and June) were nearly the same as last year and larger than ever before. For the first half of this year the passenger earnings of this road were $147,650 (6 per cent.) less than last year and almost identically the same as in 1883. The recent more favorable passenger earnings are a good sign. For the half-year they have been for three years:

1883	1884.	1885.
$2,297,395	$2,445,114	$2,297,464

The freight earnings until June were larger than last year in every month except February, when the road was blockaded. In March the increase in freight earnings was 33 per cent., in April 19 per cent. and in May 8 per cent., but in June last there was a *decrease* of 5 per cent. For the half-year ending with June the freight earnings for three years have been:

1883.	1884.	1885.
$8,561,858	$8,465,966	$9,284,702

The increase over last year is 9⅜ per cent.; over 1883, 8½ per cent.

The miscellaneous earnings increased enormously last year, being for the six months 27 per cent. more in 1884 than in 1883. This year there was a large gain in the first three months of the year (32 per cent.), but none at all in the last three months ($390,858 against $392,484). These miscellaneous earnings for the half-year have been:

1883.	1884.	1885.
$545,950	$694,941	$790,801

The gain since last year is but 14 per cent., but since 1883 it is no less than 45 per cent., and makes a substantial addition to the profits of the road, no doubt.

Record of New Railroad Construction.

Information of the laying of track on new railroads in the current year is given in the present number of the *Railroad Gazette* as follows:

Atchison, Topeka & Santa Fe.—The *Southern Kansas* line is extended from Hazelton, Kan., southwest to Kiowa, 8 miles.

Chicago, Burlington & Quincy.—The *Western Iowa Branch* is extended west to Cumberland, 16 miles.

Kansas City & Southwestern.—Track laid from Beaumont, Kan., southwest 38 miles.

Los Angeles & San Gabriel Valley.—Track laid from Los Angeles, Cal., east to Pasadena, 10 miles.

This is a total of 72 miles on 4 roads, making 1,377 miles thus far reported for the current year. The new track reported to the corresponding date for 14 years past has been:

	Miles.		Miles.
1885	1,377	1878	1,005
1884	1,905	1877	943
1883	2,942	1876	1,231
1882	5,782	1875	607
1881	3,180	1874	916
1880	2,704	1873	2,028
1879	1,346	1872	3,485

This statement covers *main track only*, second or other additional tracks and sidings not being included.

NEW PUBLICATIONS.

Friction and Lost Work in Machinery and Millwork. By Prof. Robert H. Thurston, A. M., C. E. John Wiley & Sons, New York.

The title of this work has the rather unusual fault of being somewhat too restricted, there being almost no form of friction of practical importance in the arts which is not discussed in it, more or less. It is also a treatise on lubricants as well as friction, a very large part of the work being given to their chemical and other characteristics, it being in fact an extension of the little work by the same author on "Friction and Lubrication," published in 1879 by the *Railroad Gazette*, which title would still most exactly describe its character.

The new volume, like the old, is very largely the result of original investigations by the author, and we judge it to be the best and fullest work of the kind in the English language, and one of great value. Much that is contained in it would a few years ago have been regarded as heretical and well nigh impossible, for it is one of the most curious facts in the history of engineering that until within the last few years experiments made almost half a century ago (by Morin) with very imperfect apparatus, and having a most limited scope, should have been accepted as decisive and complete, without any claim of that kind by their author, by the whole scientific and mechanical world, and so have filled our text books, pocket-books and encyclopedias with what, in the light of present knowledge, seems most absurd misinformation; as, for instance, that friction is independent of the areas of the surface in contact and of the velocity, with both of which it is now known to vary greatly.

Professor Thurston has taken a leading part in the investigations which have in recent years added so much to our knowledge of the laws of friction, and the summary of his own and others' labors in this field seems to be very complete, almost to the date of publication. Thus, Mr. Beauchamp Tower's recent experiments are fairly summarized, although hardly so fully as their great importance and interest would seem to merit, perhaps because they have so recently appeared that their inclusion was in a measure an after-thought after the main body of the book had been completed. We notice also what would appear to be an error, or at least an omission, in the summary given of these experiments: It is stated that "the friction was determined by the use of a brake somewhat resembling that of Prony." It is true that such a brake was used for portions of Mr. Tower's experiments, but a great portion of them, and we infer nearly the whole of the more important ones, were made by actually *weighing* the strains by weights directly resisting the tendency to rotation caused by friction.

The first 103 pages are devoted to a (highly) mathematical discussion of the theory of friction, the next 104 pages to a treatise on lubricants and their inspection and test, containing a great amount of valuable and definite information on the subject, and the next 150 pages contain a summary of the existing stock of experimental knowledge on friction, freely illustrated with diagrams of the greatest interest and value, the chapter almost exhausting the subject so far as understood to date, the most serious criticism being that more time might well have been given to digest, analyze and compare.

A more serious criticism on the book as a whole, however, is that it makes unduly prominent the effect of mere differences in the lubricant on the loss by friction. If there be any moral which can be unmistakably drawn from Mr. Tower's experiments, as well as from all practical work, it is that the quality and character of the lubrication are immensely more important than the quality and character of the lubricant; that any oil, even the cheapest, well applied, is better than the best oil poorly applied. Now Professor Thurston's investigations have been largely in the direction of distinguishing between lubricants, an important and desirable field for investigation, but one which should not therefore be made unduly prominent, as we think it is, so as to convey the impression to the mind of an inexperienced "searcher after truth," that the difference in the quality of the lubricant used is a chief instead of a very subordinate cause of "friction and lost work." The importance of all these other causes, both relative and absolute, is mentioned and even enlarged upon in various paragraphs of the work, to be sure, but the general tendency of the volume is to dwell upon the quality of the lubricants as the most vital thing, and in the closing chapter, on "The Finance of Lost Work," this error of treatment is carried into definite figures to an extent laying it liable to the most serious criticism, as cannot be better proven than by the following "application" to what is euphoniously called "railroad practice:"

"Assume an oil costing 25 cents (misprinted 35 cents) per gallon and giving a mean coefficient $f_1 = 0.01$" [this coefficient means a rate of friction due to 20 *lbs. per ton for journal friction only*], "and the cost of wear and tear and of that part of the fuel used on the engine in overcoming the resistance of lubricated surfaces *which may be taken as two-thirds the whole quantity burned*" * * * "to be, for example, $0.20 per mile, and the quantity of oil used per mile to be 0.02 gallon."

A more unwarranted exaggeration than in the italicized sentence we have rarely seen. The "lost work" from wind resistance, from rolling friction proper, from curvature, from oscillation and concussion, from grades, from brakes and other losses in stopping and starting, from radiation, from cylinder condensation, all account for only 33 per cent. of the coal burned, "and the friction of lubricated surfaces" for 67 per cent! Ten or fifteen per cent. would probably be much nearer, and 20 per cent. an outside limit for ordinary trains.

From the assumptions above quoted it is concluded that "the total expense per train mile to be charged to the lost work of friction" is 20¼ cents—20 cents for friction and ¼ cent for oil. Then we are told, however:

"Were it proposed to use an oil costing 10 cents per gallon at the rate of 0.04 gallon per mile, *with a coefficient of friction of* 0.02 [making 'lubricated' friction only 40 lbs. per ton!] the cost would be"—omitting as before the equations in which the simple fact is embodied—0.4 cent for oil and 40 cents, or twice as much, for "cost of work and wear and fuel."

It is such preposterous methods of generalization as this which lead practical men to look with contempt on "theorists." There are several other details of this comparison, besides those already noted, which invite criticism, but passing these, and granting for argument only, what cannot otherwise be granted, that as the examples were only examples they should not be expected to bear even approximate relation to actual practice, would Professor Thurston tell us that because the coefficient of one oil might be 50 per cent. more or less than another *in a testing machine*, the loss of friction of machinery in a mill using the one would therefore be 50 per cent. greater than in a mill using the other, or even in the same mill? Does he furthermore believe that the *whole* cost of power would increase directly with the resistance? That is what he tells us in effect.

Beyond doubt, it is well, as stated, to fully investigate the qualities of various oils and their applicability to various uses; but that having been approximately determined, there is, for railroad uses at least, no little reason for approving the principle which has been embodied in the maxim, "the cheapest oil and the best of care." Taken *neat*, the maxim is liable to abuse, but it embodies a sound principle and one fully in accordance with what is known of laws of friction. Assuredly, it is a safer guide for practical railroad men than Professor Thurston's "criterion."

Nevertheless, the book is a good book, and its summary of existing experimental knowledge on the laws of friction and of the properties and mode of testing various oils makes it a useful one for practical railroad men.

TRADE CATALOGUES.

Catalogue of Works Executed, accompanied by Illustrations. Wilson Brothers & Co., Civil Engineers, Architects and Consulting Engineers, Philadelphia, Pa.

We hazard nothing in stating that this is, on the whole, the handsomest and most tasteful publication of the kind which has ever appeared in the United States, and that, as most of our readers know, is saying a good deal. It contains 57 fine "photo-collotype" or heliotype engravings of various architectural designs, including some 15 or 20 station buildings, 11 similar views of various bridges, and four of roofs and similar miscellaneous iron work, each of which is accompanied by a description. An accompanying "statement of the principal items of work executed" by the firm makes really a remarkably showing, including 104,343 ft. (19.76 miles) of railroad bridges, by single-track measurement, and 6,126 ft. (1.16 miles) of highway bridges, six pages of station and ship buildings, and as many more of other architectural works. That it should be possible for a firm acting—as they take pains to emphasize—purely as engineers and designers, and not at all as contractors or builders, to attain such success as these figures indicate, is a most encouraging sign of progress for engineers, who feel that it is a great detriment to their profession that under existing American customs, office practice as specialists of any kind is almost an impossibility, so that the only resource for engineers is to "sell their time" by working on a salary—or, to give it away, looking out for a salary.

The hopefulness of this instance is much diminished, however, by observing that the immense majority of the bridges and buildings designed for railroads by this firm, although by no means all, have been for a single client, the Pennsylvania Railroad and its allied lines, of which, in fact, Mr. J. M. Wilson is and long has been the official "Engineer of Bridges and Buildings." But as respects the firm, this detracts but little from the merit of the showing, for although such favors may be obtained, they are not likely to be retained without genuine merit and skill, and the list of works designed, quite apart from those which may have been due, in part or whole, to the influence and favor of the Pennsylvania Railroad Company, is alone a large one, especially among the architectural work, as, for instance, the large amount of work done for the West Shore road.

Certainly no series of designs could well be more beautifully presented than in this volume, which presents a record which is perhaps unequaled and of which the firm might well be proud, even if it contained nothing but what they have designed for the Pennsylvania Railroad.

Saxby & Farmer's Railway Safety Appliances. Saxby & Farmer, Kilburn, London, N. W.

The debt of railroads throughout the world to the firm of Saxby & Farmer is a great one indeed, for since the germ of the interlocking signal system of to-day was introduced in 1856 by Mr. Saxby, the firm has taken a leading and for a long time the only part in its introduction, against no little early discouragement and opposition, which, however, has long since disappeared. Few single firms have so long and honorable a record, a record which entitles them to be regarded as public benefactors as well as business men.

The present catalogue is a large folio publication containing full plans of several large yards and many detail drawings of every part and detail of signal apparatus. As such it cannot but be instructive and interesting to railroad men having to do actually or prospectively with interlocking apparatus. It is claimed by some American and other makers that other systems are more perfect in some of their details than the Saxby & Farmer apparatus, and this is not impossi-

ble, but certainly no one can deny to the firm the credit of having originated and introduced the whole system, and of being not only the first but as yet by far the largest manufacturers of such apparatus. In fact their business so immensely exceeds all others in the same line, that they may without essential error be said to make interlocking signals for the world. They are represented in this country by the Union Switch & Signal Co., of Pittsburgh, Pa., who issue a separate catalogue and make some few signal details specially adapted for our requirements which the parent firm does not make.

It is pleasant to note from such examples as this firm, and many others which might be instanced, that it is becoming more and more the rule in our time that the originators of really great improvements profit by them individually in due proportion to their value. Had poor Trevethick been born in our day, we may well believe that his sad history would have been very different, and that he would have prospered as has Sir Henry Bessemer for no greater inventions.

Illustrated Catalogue and Price-List. Livermore Foundry and Machine Co., Memphis, Tenn.

The time has been, and not very long ago, when to receive a catalogue of this kind from a point so far south as Memphis, Tenn., would have excited some surprise. That it is no longer so is a most gratifying sign of progress. The catalogue is neatly prepared and quite full, giving a long list of manufactures of cast and wrought-iron which are dealt in and in the main manufacturered by the company. A specialty seems to be castings of all kinds used for buildings and shafting, hangers and other shop supplies.

A leading department of the company's business is the furnishing of railroads with castings, brasses and other similar supplies, for which business it is certainly no disadvantage that the President of the company is an old railroad officer, he having been General Superintendent of the Mississippi & Tennessee and Memphis & Little Rock roads for 13 years.

Railroad Policy in Germany.

[From "Railroad Transportation, Its History and Its Laws," by Arthur T. Hadley, a volume to be published about the close of 1885 by Geo. P. Putnam's Sons.]

The contrast between Germany and France, so manifest in almost every department of history, could not fail to show itself in the railroad systems of the two countries. That of France was planned under a carefully devised scheme. It radiated from Paris as a centre. It formed a national network, where each part was subordinated to the whole. That of Germany, on the other hand, grew up without any comprehensive plan. The first lines did not even come into communication with Berlin. They were built as local lines to subserve local interests. This was largely due to the political constitution of the country. The smaller states pursued their own way, each for itself, without regard to national development. They were strong enough financially to adopt the policy of state ownership and carry it out consistently. They actually succeeded in doing what so many of our country towns tried to do a few years ago by municipal subscriptions; that is, they secured railroad construction for the sake of local interests, where mere business considerations would not have caused railroads to be built. They thus obtained a remarkably uniform development of lines all over the country.

But it was not from these small states that a national railroad policy was to come. The political ties which bound them were too loose to admit of common action in this matter. There was, it is true, a sort of federation of railroads established, the "Verein Deutscher Eisenbahn-Verwaltungen." This did extremely good work; but it dealt with matters of railroad administration rather than railroad policy in the wider sense. There was but one source whence a national railroad policy could arise, just as there was but one source whence political unity could come. The two movements centred in Prussia.

The original idea of the Prussian legislators seems to have been a combination of the French scheme of regulated monopoly with the exploded English notion of competition of different owners of rolling stock on the same line of rails. The law of 1838 explicitly recognized railroad monopoly rights, protecting them for 30 years against parallel railroad construction. But the scheme was never consistently carried out as it was in France.

About 1842 the policy of subsidies came into vogue; not on the French system, but in the form of guarantees of interest. With these guarantees there was a further proviso, that if the state was compelled to advance money in this way, it might, after a certain length of time, undertake running the road itself. Other roads were indirectly countenanced by the purchase of stock on the part of the state, which was thus gradually carried on in the direction of railroad ownership. The first absolutely state-built and state-managed road was one from Berlin toward the Russian frontier, begun in 1848. This was built on military grounds, without much regard to business considerations. Down to 1860 the government continued building a few roads, and at the same time quietly purchased a good deal of railroad stock, devoting to that purpose the proceeds of a special railroad tax.

With the advent of Bismarck to power in 1861, military matters thrust industrial ones into the background. Even the railroad tax was diverted to political purposes. The consolidation of Germany into one nation by the wars of 1866 and 1870 created new lines of traffic, and a demand for new railroads. These were largely built by private companies. The Prussian administration was too much occupied with other social and political questions to give the railroad problem its final solution, or even to decide upon its own ultimate policy in the matter. The time preceding the crisis of 1873 was a period of active railroad speculation, in which the state itself was a participant. In Prussia, as in Belgium, state railroads were simply roads owned by the state, but managed on the same principles, and with the same abuses, as competing private roads.

This was the condition of things down to 1874. At that time the German railroad system was a "mixed" one in the fullest sense of the term. The small states had owned their own roads, in large measure, from the outset. Private enterprise had improvised connections and built through lines. Prussia owned about one-third of the railroads within her borders. Some she had built for military or political necessity, some she had acquired in the way of business, some she had assumed when she annexed the states that owned them.

Bismarck was far from satisfied. He wanted to see a consistent state railroad system, and that not in the hands of the individual governments, large or small, but in the hands of the imperial power itself. He seems to have had this idea in mind from the first. The power of the Empire to regulate railroads was established and defined in a series of articles (§ 41–47) of the imperial constitution. This was in 1871. In 1873 a railroad commission (or rather "Railroad Department," *Eisenbahnamt*) was established, consisting of seven members, having power to carry out the provisions of the constitution, among which was one providing for the regulation of rates, to secure publicity, and to do away with abuses. By this authority a great deal has been done to secure unity in matters of construction, signals, liability, etc. In the matter of rates it has done comparatively little. This is practically not under the control of the Empire, but of the individual states.*

The imperial authorities wanted to do more than control the railroads; they wanted to own and manage them. The first step in that direction was taken in the years 1870 and 1871. When Alsace and Lorraine passed under German sovereignty the German Empire, as such, was the only authority to take charge of the railroads of those provinces, which could no longer remain under the management of the French company to which they had hitherto belonged. This was but a beginning. Four years afterward there was a strong agitation in favor of transferring all railroads in all parts of Germany into the hands of the Empire. The project met with favor in Prussia; but in other parts of Germany, especially in Bavaria and Saxony, the states-rights feeling was too strong, and the plan was after a time abandoned.

Foiled in his purpose of a German state system of roads, Bismarck attempted to widen the Prussian state system; and here he succeeded completely. In 1878 there were only about three thousand miles of state-owned roads; two thousand miles more were owned by private companies but managed by the state, while six thousand miles, or more than half, were under private ownership and management both. The state roads themselves were rendered less powerful than the mere figures would indicate, because they were divided into two practically unconnected systems, the Eastern and the Western. This defect was remedied in the autumn of 1879, when the government, by a series of purchases, obtained control of two important east-and-west trunk lines connecting Berlin with Cologne. At the same time a number of other roads passed into government hands. The tendency was too strong to be resisted by the private companies. By the close of the year 1881 the government virtually owned seven thousand miles of road, besides managing two thousand miles more; while there were little more than three thousand miles left in the hands of private companies. Two of these companies were financially very strong—the "Anhalt" line connecting Berlin with the south, and the Hamburg line toward the northwest. But the government was resolved not to leave its work incomplete. The Anhalt road was purchased in 1882, the Hamburg road in 1884. There are now in Prussia about 13,000 miles of state roads and only 1,000 miles of private roads.

The prices paid were liberal, and sometimes extremely high. The stockholders of the Berlin-Hamburg Company secured an income of 16 per cent. on the investment; this was decidedly the highest price paid for any road. The purchase was generally made by exchanging for the securities of the roads Prussian 4 per cent. bonds in such amounts as should give the holders about the same income that they would presumably have received had the roads remained in private hands. There was no compulsion exercised. The government offered prices which made it worth while for the companies to sell. The government had a technical right to take the property at a valuation, but it seemed better to make a slight pecuniary sacrifice rather than incur the odium of enforcing this right.

Prussia is now the typical example of state railroad ownership. Of Prussian railroad employés, 112,000 are regularly appointed members of the civil service, with special rights and duties as such. The railroads are made to subserve political and military purposes quite as much as commercial ones. To examine and pass judgment upon Prussian management or Prussian rates, is virtually to pass judgment on state railroad ownership as a system.

* We must not confuse the Prussian government with that of the German Empire, merely because the King of Prussia is *ex-officio* Emperor of Germany. If the Governor of New York were *ex-officio* President of the United States, the administrations, national and state, might still remain entirely distinct, with distinct spheres and rights. Such is actually the case in Germany.

Foreign Technical Notes.

German railroads report unfavorably on the effects of tarring as a protection against rusting of rails in tunnels.

A case is reported in German practice where leaky masonry was made good by clearing out the joints, calking with oakum, and then pointing up with cement.

European and American practice is reaching a remarkable unanimity on the superior merits of the balanced swing-up crossing gate over all others.

It appears that notwithstanding the almost universal belief that notches in the base of steel rails are injurious to the rails, several important German railroad systems have continued notching, with no recorded injury and much satisfaction as to creeping.

At small water stations where supply is from wells or cisterns which cannot be placed high enough to supply tender tanks by gravity without pumping, German experience has found it profitable to use injectors or pulsometers worked by steam from the locomotive.

The question whether a new grain warehouse at Riga should be a bulk elevator or a sacked grain house has recently been decided in favor of the bulk elevator, in spite of unfavorable financial experience with such houses at different points of Europe, such as Hamburg and Trieste. This latter experience was adjudged by the Riga promoters as due to local circumstances and not to unsuitability to European ways of business.

There is a general feeling in Europe that the day of horse traction for street surface roads is over.

Cable roads are being introduced somewhat into England, but on the continent individual motors are looked upon with more favor.

Stephenson's original objection to cable traction and to electric systems seems equally applicable here as it is to railroads, viz., the absolute interruption to the whole traffic by the failure of the power conductor.

Herr Ferdinand Förster, in a late number of the *Organ*, calls attention to errors arising where value of coal for evaporation is regularly tested.

Coal, if wet down by firemen, should be wet completely before weighing at all, otherwise the residue at the end of trial appears too great and the result is too favorable to the coal. Serious errors have also arisen with the same result, through measuring the feed-water before it had got into the tank, thus disregarding loss by splashing and overflow, and through taking depth of water in the tank with engine on a grade.

The answers of the railroads to whom the question of the advantage of iron or steel ties was submitted last year by the German Railroad Union were most non-committal, and into the question of comparative cost no answer whatever was even asked.

It appears that with any practicable proportions the cost of steel or iron ties, even in Germany, is three to four times that of first-class wooden ones, a difference which no consideration of greater durability could overcome. Why, therefore, iron and steel ties have found so much favor in Germany is difficult to see from a rational point of view.

An Austrian engineer has been taking a census of the narrow-gauge railroads of Europe, which are mostly street railroads—that is, lines laid in streets and highways, but for the most part worked by steam—for which the room cannot always be easily spared. He finds in Austria two small narrow-gauge roads, besides the line 166 miles long in Bosnia, which the Austrian government has built as a military road. In Germany there are about 250 miles; in Belgium, 37 miles, one of which is one of the oldest in the kingdom. Of the 319 miles of street railroads in Holland, nearly one-half are of narrow-gauge. In France there is a company which builds local roads of the metre gauge (3 ft. 3⅜ in.), but the Austrian census-taker does not say how much such roads are built. We can say for him, however, that there is a considerable mileage of it. All the numerous street railroads of Lombardy are of standard gauge. Switzerland has 320 miles of narrow-gauge road. Altogether, there is in all Europe, apparently, nearly enough narrow-gauge road to equal in length the Denver & Rio Grande.

From the German *Organ for Railroad Progress* we extract the following method of checking up the track watchmen as practiced on the Russian road from Charkov to Nikolajev. The track is patrolled before each train by a watchman on each section, who carries forward a number found by him at the beginning of his section and left on a hook provided for it at the end, even numbers being carried in one direction and odd ones in the other. The numbers, which are painted on metal plates, are hung in view of the trains, so that officials passing can readily see them, and by means of a small table of the positions of the numbers on any day or hour can see whether the watchmen are doing their work. A hook without a number indicates the negligence of a watchman, who can be readily identified, since every watchman is required to give notice when he does not find a number at the beginning of his section, and must do so to avoid having the carelessness ascribed to him.

Similar methods to the above are in use on almost all German roads, viz., the carrying of a number over the section and the placing of it on a hook or in a conspicuous place prepared for it. They do not involve, however, the moving along of numbers from one section to another, which makes it almost impossible to omit any of the inspection trips en-

tirely. It is complained, however, by a few roads that the actual inspection is evaded either by sending children with the number or by short cuts on very crooked sections. These reasons do not seem to militate against the above-described system, but merely show that it is not capable of preventing all dishonesty, and requires supplementary vigilance.

Glazed stoneware is approved by German authorities for side drains and for small culverts, where the foundation is good and free from frost. It may be added, from American experience, that only where the greatest care is taken to have the ground cut out exactly to the form of the pipe is it likely to answer, and that the pipes should be protected at the ends by curtain walls or sheet piling. Under heavy banks it will be found advantageous, where the fall of the culvert is slight, to give a slight camber to the grade to allow for compression of the foundation under the centre of the bank.

It is rather curious that while in England, where the block signal system has been so fully developed, few if any of the systems attempt to control the danger signal at the beginning of a block from the further end of it, so that a signalman is able to lower his signal to safety for the passage of a train into a block without receiving the proper "train out" signal from the other end. In Germany, in introducing the system, the acknowledgment of "train in" from the further end of a block locks the signal at the entrance at "danger," and at stations on some roads the station agent has to give an electric signal before the signalman can let a train out or in.

For the years 1884 and 1883 the percentages of wheel tire breakage per 100 tires in use on German railroads were as follows:

	1884.	1883.
Locomotives	0.55	0.80
Tenders	0.48	0.85
Passenger cars	0.28	0.50
Mail "	0.69	0.80
Baggage "	0.25	0.60
Freight "	0.23	0.35
Average of all rolling stock	0.25	0.39

while the six winter months 1880-1881 gave 0.33 per cent. of breakage.

The temperature last winter was much more favorable than that of 1883, and detailed returns show that these breakages follow the temperature with remarkable sensitiveness; evidenced as well by the above table as by the fact that for every break in 1884, 1,774,623 axle-miles were run, while in 1883, a break occurred for every 1,217,879 axle-miles. Of the whole number of breakages 67 per cent. were discovered in station and workshop inspection, so that only one derailment occurred for each 343 breaks, and one delay for every 18.

A very careful and practically scientific analysis of observation on a number of broken crank-pins made by Master Mechanic Maiss, of the Prussian State Railroads, gives the following result:

These pins almost always show that the breaks are the result of several shocks, and not of one strain, evidenced by the fact that the breaks are divided into several zones, exhibiting distinctly different degrees of rusting and discoloration from dirt. Secondly, from the direction of the breaking axes of these zones, it appears that breakage always takes place just before reaching the dead points. Thirdly, from the direction of the break, it is caused not by the pull from the steam, but from a pressure in the reverse direction. The deduction Herr Maiss makes from these phenomena is that broken crank-pins are almost always the result of water in the cylinder.

Apart from care in draining the cylinder by properly opening cylinder cocks, Herr Maiss mentions the following points of repair or design as needing care for avoidance of this difficulty.

Leaky throttles, steam passages exposed to condensation, loose valve-gear, joints not effectually opening ports, too small openings in cylinder cocks, and imperfections in repairs of connecting and piston rods, pistons and bearings, by which the clearance at cylinder ends is diminished.

He favors plane joints for cylinder-heads instead of the conical ones used in Germany, the regrinding of which latter diminishes the clearance more than where plane joints are used.

From the German *Centralblatt der Bauverwaltung* for 1884, the following account of the Vesuvius Railroad is drawn: The first projector was unable to get a footing for an ordinary construction in the loose ashes forming the surface of the mountain, and the present road, built by Signor Olivieri, is formed as follows:

On an exposed lava profile of the mountain a horizontal ladder was laid down. This consisted of three lines of longitudinal sleepers, connected by cross sleepers, and diagonally braced in the panels so formed. The centre line is double, and between the two halves are erected posts carrying an upper longitudinal sleeper; also double-clamped to the heads of the ports by through bolts.

The cross-ties of this construction are apparently leveled up on a bank of lava blocks, but the lower longitudinals follow the slope of the mountain. On the longitudinal cap of this construction is laid a single rail, on which a saddle-formed car is suspended. This runs on two wheels on the upper rail, and is kept from swinging by horizontal wheels bearing on angle irons spiked to the sides of the posts of the structure. The whole construction is double, one car descending while the other is going up, and the cars are drawn by double iron ropes, whose manner of attachment to the cars and means of support are very obscurely described. The grade of the railroad averages 50 per cent., and ranges from 40 per cent. to 63 per cent., the alignment being straight. The cars are made in two compartments, with a difference of level of about 3 ft. in the two floors, and the station platforms are made in corresponding steps. The brake consists of corrugated iron checks, which clamp the sides of the upper longitudinal beam, and is worked by a screw. The operating engine is at the lower end of the railroad, which ascends 380 metres in a length of 800.

The constant gain of the chloride of zinc process over the other modes of tie preservation in Germany, and its remarkable cheapness—only one-quarter to one-half that of creosote—must attract more attention to it in this country than it has hitherto had.

The returns of cost of the different processes made it seem, however, as if the work were not very thoroughly done, for the cost of preserving hard wood is given as much less than that of soft. Although hard wood takes less preservative to fill the pores, the difficulty of getting them thoroughly filled is so much greater that the result seems suspicious. The assumption is made that the same time and pressure suffices for impregnating both hard and soft wood, which assumption requires proof. Still, the results show at least a double life for sleepers preserved with either creosote or chloride of zinc, as far as rotting is concerned. As to cutting, no result has been reached as to relative life, since sufficient time has not elapsed to test it.

Out of 55,274 unpreserved pine sleepers laid in 1872 on the Kaiser Ferdinand Northern Railroad, up to the end of 1881, nearly 97 per cent. had been changed out, while of 23,380 similar ties impregnated, laid in 1869, 26.3 per cent. had been removed at the same time; of 12,520 ditto, laid in 1870 35 per cent.; and of 7,834, laid in 1871, 24.3 per cent. Of oak ties on the same road, out of 115,694 laid between 1865 and 1867, at the end of 10 years 2½ per cent. had been taken out and after 16 years 90 per cent., while of oak ties preserved the record was as follows:

Total changed out after	3,872 laid 1870	14,144 laid 1871	19,452 laid 1872
10 years	2 17 p.c.	1.35 p.c.	16.12 p.c.
12 years	8 03 "	.....	.....

The last layings seemed to have been a poor quality or else imperfectly impregnated. On the Empress Elizabeth Railroad the results with pine were less favorable. At the end of ten years, of oak ties preserved with chloride of zinc 8.8 per cent. had been changed out, and of pine 74.8 per cent.

The impregnation of oak ties with chloride of zinc cost on an average in Germany and Austria 37 pfennigs (9 cents) per tie; assuming that it would be double that here—a pretty liberal margin—the cost would be 18 cents per tie, and with oak ties it would seem pretty clearly a paying operation to preserve, particularly when the labor of changing out is taken into account.

Longitudinal sleepers prove more favorable to tires than cross sleepers, in the proportion of 1.7 breaks for longitudinal to 4.5 breaks for transverse sleepers in 100 kilometres of track (comparative amount of traffic not stated).

Forty-eight per cent. of the breakages showed bad material, 3 per cent. bad welding, and 34 per cent. clean breaks; 34 per cent. of the breaks appeared to be old ones which had passed one or more inspections.

The chief causes of breaks were bad material, too strong shrinkage on the wheel centres, action of the brakes and sudden change of temperature. Less frequent causes are the holes for bolts, rivets and screws, and the grooves for spring rings, while a theory that the breakages were in proportion to the number of times the tires had been turned up has not received confirmation.

The effect of high speed on breakages is evident from the greater frequency of their occurrence in fast trains; thus for every million axle kilometres there were:

In fast passenger trains	0.37 break.
In accommodation "	0.17 "
In freight and mixed "	0.22 "

So that at the speed of slow passenger trains other elements seem to be more important than speed in causing breakage.

The percentage of breakages to total wheels used in wheels of various kinds are as follows:

Wooden disk wheels	0.34 per cent.
Steel and iron wheels with separate tires	0.30 "
Spoke wheels with separate tires	0.26 "
All wheels with tire solid with centre	0.06 "
Chilled cast-iron	0.38 "

Of the latter, only 1,819 wheels were in use, and they are not used at all with brakes, and are forbidden on most roads, which have required all solid wheels to be of steel, and exclude them in any event from use under brakes.

This has a bearing on the small percentage of breakages in this class. Even allowing for that, the class of wheels without separate tires shows extraordinarily well, particularly as the chilled cast-iron wheels, with their high percentage, seem to be included in this class.

Of wheel tires, classed as to material, the breakages in proportion to numbers of tires are:

Puddled steel	0.70 per cent.
Iron	0.40 "
Cast steel of all sorts	0.20 "

All kinds of attachments by rivets and screws, etc., with the body of the tire are going out of use, and spring rings and screw attachments to an interior flange on the tire are increasing.

Railroad crossing gates in Germany are frequently operated from a considerable distance by a long wire. The counterpoise on the gate is heavy enough to open it, and it is closed by pulling up the counterpoise by the wire. This wire is sometimes run over a wheel having on the same axis a ratchet which causes the striking of a gong. To make the bell ring before the gate begins to lower, and thus give warning of that operation, an **S** loop has been made between the bell and the gate, in which, by the insertion of two pulleys connected to the short arm of a special counterpoise lever, the triple object is effected of securing an interval between the bell striking and the closing of the gate; taking up the slack of the wire by the action of the counterpoise in extending the loop by means of the double pulley; and thirdly, the display of a danger disk attached to the counterpoise, which is so arranged as to be covered when the gate is open. By this plan the bell sounds before the gate is lowered and again after it is raised, and the danger signal remains up till the time that the gate is closed and a little before and after.

Herr Vojacek, of Prague, has devised an alteration in this apparatus which seems directed to the avoidance of the staying up of the danger signal after the gate has been fully raised.

The arrangement is ingenious, but seems—without further knowledge of the circumstances—superfluously elaborate, inasmuch as it does not appear difficult to insure the result desired by suitable proportions of the apparatus, which would seem decidedly advantageous in cases of gates opened in this way. It might render it practicable to operate a gate in this way where, owing to the approaches of the crossing being out of sight of the gate tender, it would not be so without means of preliminary warning to persons about to cross.

THE SCRAP HEAP.

A Cold Water Boy.

Last winter—how pleasant it is to think of a time when it was cold enough for overcoats—as we sailed down the J., M. & I., known among the native Hoosiers as the "Jeff" road, there were several things to look at. There were two dramatic troupes on board and a boy from Indianapolis who had designs on the water tank. He began drinking before we fairly got out of Indianapolis. He would drink as long as he could hold his breath, and then put down the cup and sigh, and go back to his seat. When he felt a little rested he would march down to the tank again, and looking over the rim of the cup with an injured expression as he drank, gaze at the passengers as reproachfully as though it was our fault that he couldn't hold a tubful of water. Then he would sigh and go back to rest. Then he'd come up again, a little bit groggy, but still in the ring, drink till the water stood in his eyes, and go back to recuperate. Once or twice the brakeman drove him away from the tank. "Somebody else might want a drink before we get to Madison," he said, "and any how there was no coroner on the train if the boy should succeed in drowning himself." Still, the boy, eluding the vigilance of the careful brakeman, kept on drinking great quantities of aqua pura, with brief intervals for rest. Presently the brakeman came in, after fighting with a man who didn't want his two dogs banished to the baggage car, and wrestling with an old lady who had got it into her head, just because he told her that she couldn't go in there, that the smoking car was just the very Alabazan car of all Alabazan cars, and fought to get into it. He was pretty hot, because he hadn't half whipped the man and couldn't rip out on the old lady, and he was just hungry for a chance to "blow off" somebody. The first thing his eyes fell upon was the boy at the water tank. He swept down upon him, grabbed him by the shoulders, shook his hat off and the breath out of him before the boy could yell, lifted him up in the air, slammed him down in the seat with a Langtry bang that shook open the ventilators. "There!" he roared; "you dropsical little squab! D'you want to make a millpond of yourself and be——" The boy's face was purple with rage, and he broke out into a torrent of profanity, abuse, defiance, threatening and slaughter in one awful breath. He danced out into the aisle, shed his coat, beat his fists together and pulled a revolver. Everybody yelled and hollered and laughed and stood up on the seats and applauded the boy and encouraged the poor, dumfounded, stammering, blushing, apologizing brakeman. Poor Ixion! in his blind wrath he had swooped down upon an irascible, cross-grained little wretch of a dwarf, 41 inches high and 52 years old, belonging to one of the dramatic companies. It was too funny for anything, for the rest of us. And while the row was absorbing general attention, if that miserable boy with the hydrophobia didn't sneak up to the water-tank and drink it so dry that it warped.—*Burdette, in Brooklyn Eagle.*

A Railroad President Paralyzed.

A railroad president, now deceased, used to tell with much enjoyment the story of the only instance within his knowledge wherein an honest and true reason was given for asking a "pass." One day the son of a prominent citizen came along—a brisk young chap—and said: "Mr. Doubletrack, I will be obliged to you if you give me a pass to Boston," and gave no reason at all. Mr. Doubletrack asked his young visitor: "Why should you have a pass?" To which the rejoinder came promptly: "Well, I don't want to pay!" Astonished at this plain telling of the truth, Mr. Doubletrack gave him the pass.—*Philadelphia Press.*

The New Travelers' Protective Union.

The establishment of the Travelers' Protective Union is an event upon which all decent railway travelers can congratulate themselves. The object of the society is to bring about the abolition of certain nuisances which at present greatly interfere with the comfort of travelers, and a glance at the prospectus gives us great reason to hope that the society will do its work effectively.

On joining the Travelers' Protective Union the new member pledges himself to observe certain rules. The first of these is always to throw out of the window whatever paper, book or package the peripatetic newsboy may lay in the member's lap. The framer of this rule was doubtless inspired by the example of the noble old lady referred to not long since in this paper who threw out of the window the various articles which were unlawfully deposited in her lap. If the rule is faithfully observed, it will be a very short time before the newsboy ceases his persecution. Three travelers on any train who should each throw a package of prize candy, a newspaper, a book and a banana out of the window would prevent the newsboy from making any profit whatever, and six travelers who should perform a like beneficent feat would bankrupt the boy. If the society carries out its purpose thoroughly for, say, three weeks, not a newsboy on any railroad in the country will venture to thrust his property in a stranger's lap.

The members are also bound to suppress the man who turns over the back of the seat in front of him in order to put his legs on the seat. The method to be pursued is to

suddenly turn over the back of the seat and drop it on the offender's legs. If it breaks one or two of them no harm will be done, for there is good legal opinion in support of the claim that the man who puts his legs on a seat that does not belong to him does so at his own risk. If the legs do not break they will at any rate suffer acutely, and the man who has been thus punished will be very careful not to put himself in danger a second time.

The woman who manages to occupy four seats by turning over the back of one of them and filling them all with her person and bundles is to be punished by a very admirable method. In every railway town the society will have in its pay one or more particularly fat negroes with great powers of perspiration. When a member sees a lady thus preempting four seats, he will telegraph to the next station for one of the society's negroes. When the train arrives at the station the negro will enter the car of the offender, remove a few of her bundles, and seat himself next to her. He will be forbidden to speak to her or to annoy her in any way except by his presence. We may feel very sure that any woman who learns of the existence of the society and of its proposed methods will abstain from risking its vengeance.

There are other railway nuisances which should be combated, as to which the society will, at an early day, adopt some method of proceeding. Such are the man who keeps the windows open on a cold or dusty day, the man who will have no ventilators open at any time, and the man who tries to induce the brakeman to make the fire hotter when the temperature of the car is already above seventy. How to treat these nuisances is a difficult question, and the society has wisely decided to do nothing in regard to them until it can devise a plan to which no objection can be made. Nothing is said in the prospectus concerning the steam whistle, but it is hardly possible that the society intends to ignore it. Let us not, however, find fault with so admirable a society merely because of its omissions. It will do a grand work even if it confines itself wholly to the suppression of the train boy and the man and woman who occupy more seats than belong to them, and the society will have the good wishes of every intelligent and philanthropic man.—*New York Times.*

TECHNICAL.

Locomotive Building.

The shops of the Central Railroad, of Georgia, in Savannah, Ga., have just completed 2 new passenger engines for the road. These engines are employed on the fast mail train between Savannah and Atlanta.

Bridge Notes.

The Berlin Iron Bridge Co., at East Berlin, Conn., has just received the contract for a new iron bridge to be built across the Susquehanna River, at Williamsport, Pa. The bridge will be 1,000 ft. long, consisting of 5 spans of 200 ft. each.

The Morse Bridge Co., in Youngstown, O., has received a contract for a large highway bridge to be built across the Mississippi River, at St. Paul, Minn. The total length of the bridge will be more than 1,500 ft. It will have one span of 350 ft., three of 200 ft. each, one of 176 ft., one of 150 ft., one of 65 ft., and about 250 ft. of trestle work approach. The bridge will be 54 ft. wide over all, with a roadway of 32 ft. clear, and two sidewalks of 10 ft. each. The contract price for the superstructure is $191,000. The bid of the Morse Bridge Co. was not the lowest, but its plans met with most approval from the committee.

The Boston Bridge Co. has just completed a double track iron bridge over the Connecticut River near Montague, Mass., for the Fitchburg road. The bridge has 3 spans of 180 ft. each, and 2 of 50 ft. each. The same company is building a bridge over the Deerfield River, also for the Fitchburg road.

Iron and Steel.

The Standard Steel Casting Co., at Thurlow, Pa., has just completed a casting for a hydraulic upsetting machine, weighing over 27,000 lbs. This, it is claimed, is the largest open-hearth steel casting ever made in the United States.

J. P. Witherow & Co., of Pittsburgh, have a contract for putting up two converters for the Paxton Rolling Mills at Harrisburg.

Mary Pratt Furnace, in Birmingham, Ala., has gone out of blast for repairs. There are now 10 coke furnaces in Alabama, of which 8 are in blast and 2 out.

Oakdale Furnace, in Roane County, Tenn., has gone out of blast.

Lanesboro Furnace, in Lanesboro, Mass., is preparing to go into blast. It will be the only blast furnace in Massachusetts in operation.

Messrs. Edward Cooper and Abram S. Hewitt have brought suit in the United States Circuit Court in Philadelphia, claiming $100,000 damages from the Pennsylvania Steel Co. for alleged infringement of the patent granted to Emile and Pierre E. Martin for an improved process for converting iron into steel, which patent was not bought by the plaintiffs.

Manufacturing and Business.

The Mississippi Glass Co., whose works are in St. Louis, manufactures ribbed and hammered rough glass and skylight glass. It also carries on the manufacture of cathedral glass in various colors and tints. This glass has been approved and is now largly used by prominent architects, and is also used in passenger cars. The company is represented by Mr. A. L. Rowe.

The Rail Market.

Steel Rails.—The market is steady with a considerable business doing in small lots at $27@$27.50 per ton at mill. The eastern mills are generally pretty well supplied with orders. A meeting of steel rail makers was to be held at Long Branch this week for the purpose of discussing measures to secure some advance in prices. As at previous meetings of this kind, however, there will probably be considerable difficulty in securing concerted action.

Rail Fastenings.—Quotations continue nominally at 1.90 cents for spikes at Pittsburgh; 2.40@2.80 for track-bolts, and 1.60@1.70 for splice-bars. There is not much business doing, and little prospect of any improvement at present.

Old Rails.—The market for old iron rails is unsettled, with light demand and a much heavier supply than for some time past. Quotations are very variable, running from $16.50@$18 per ton at tidewater, according to quality. Old steel rails are in light demand, and are quoted at $16@$16.50 per ton in Pittsburgh.

The Use of Signals.

On Saturday, Aug. 8, the day of General Grant's funeral, 1,200 passenger trains were run into and out of the Grand Central Depot in New York, which is used by the New York Central & Hudson River and the New York, New Haven & Hartford roads. This large number of trains was handled without delay or accident and without difficulty, mainly on account of the excellent system of block signals and of interlocking signals and switches in use there, which was completed not long ago by the Union Switch & Signal Company.

Blast Furnaces of the United States.

The *Iron Age* says: "We give elsewhere the regular monthly statement of the condition of the anthracite and bituminous furnaces of the country, showing the number in and out of blast Aug. 1, 1885. The table in a condensed form, presents the following:

Fuel.	In blast.—No.	In blast.—Weekly capacity.	Out of blast.—No.	Out of blast.—Weekly capacity.
Anthracite	77	20,530	144	33 109
Bituminous	86	44,815	138	49,572

"To furnish data for comparison the following table is presented, showing the number of furnaces of each class in blast on the first day of each month of the present year, and the capacity of the same:

1885	Anthracite.—No. in blast.	Anthracite.—Capacity per week.	Bituminous.—No. in blast.	Bituminous.—Capacity per week.
January 1	86	21,564	82	36,812
February 1	81	21,180	87	41,633
March 1	86	22,889	91	46,774
April 1	82	21,704	90	45,655
May 1	80	20,729	95	46,397
June 1	79	19,834	94	44,498
July 1	81	20,444	92	43,943
August 1	77	23,530	86	44,845

"From this table it will be noted that, though since June 1 there have been some changes in the number of furnaces, there has been no material change in the capacity, which is the true index of the production rather than the number. There are four less anthracite furnaces in blast than there were a month ago, but the capacity is 86 tons a week more. There are six less bituminous furnaces in than July 1, but the capacity is 902 tons a week greater. In a word, the changes in the furnaces, some going out and others blowing in, is, on the whole, in the line of increased capacity per furnace, those going in being larger producers than those blowing out. Compared with a year ago, there are some changes. On Aug. 1, 1884, there were 95 anthracite furnaces, with a weekly capacity of 26,144 tons in blast, or a capacity of some 6,000 tons per week more a year ago than Aug. 1 this year. In bituminous furnaces there is little change—88 in blast, with a capacity of 43,877 a year ago, as compared with 86, and a capacity of 44,845 this year, a little over 1,000 tons a week more."

The New Exposition at New Orleans.

Reports from the managers of the North, Central and South American Exposition at New Orleans state that the coming exposition will far surpass that of last season, both in the volume and variety of exhibits. Assurances of co-operation have been received from representatives of the nations of South and Central America, and it is hoped that American manufacturers and merchants will derive substantial and lasting benefits from the intercommunication which the exposition will promote.

The President of the new exposition management, Mr. S. B. McConnico, is widely known to railroad men from his long connection with the Chicago, St. Louis & New Orleans road. Applications for space are received by Gen. C. H. Barney, Managing Director for the Middle States, whose office is at No. 234 Broadway, New York.

Car Couplers.

A trial was made recently on the Denver & South Park Division of the Union Pacific of the Janney coupler, as modified by McConway & Torley, and arranged to fit the peculiar needs of that road, which is a narrow-gauge line with extremely sharp curves. A run was made from Denver to Leadville and return, with a number of officers of the road and others on board, the cars being all fitted with the new coupler. The trial resulted very successfully, the cars coupling and uncoupling without difficulty at the worst point on the road, a 24-degree reverse curve.

Western Society of Engineers.

The 213th meeting was held in Chicago, Aug. 4, President Williams in the chair.

Prof. Cooley, for the Committee on Organization of the Engineer Service for the Conduct of the Public Works of the United States, read a preliminary report.

It was voted that this report be printed, and that the other participating societies of the Association be requested to discuss the subject matter; and also that the report be taken up in this Society for discussion at the first meeting in October.

The Secretary read a paper by Mr. R. F. Hartford, On Ventilation of Buildings. The Society then adjourned.

Sleeping Cars in India.

Appavoo, Chetly & Sons, native car-builders, who carry on an extensive business in Mysore, India, have entered upon the construction of a new style of sleeping car, specially adapted for the requirements of Indian travel. Specimen cars will be exhibited at the London International Exhibition next year.—*National Car-Builder.*

Corrugated Wire Lathing.

The use of a kind of coarse wire gauze cloth as a substitute for the usual lath foundation for plaster ceilings is meeting with increasing favor both in this country and England. One form, recently patented in England and illustrated in *The Engineer*, is formed of sheets of galvanized woven wire cloth, 3 ft. wide by 8 ft. 10 in. long, with corrugations or grooves, ¾ in. deep, formed every 6 in. to 8 in., which makes the cloth rigid and keeps it from the under surface of the joists. From experiments which have been made as to the comparative merits of the woven wire and the ordinary wood lathing, it has been found that the plaster adheres better to the woven wire than to laths, and that when the plaster is heated red-hot, and suddenly chilled as by a gush of cold air or a jet of water, it does not crack and break away as would usually be the case with a ceiling on ordinary lathing, but remains in its position, thus affording, in the case of fire, protection to the joists or flooring above. Another advantage, although of lesser importance, is the preservation of the ceiling from cracks by the absence of contraction or expansion on the wire lathing and the abundant play allowed for any slight twisting of the joists by the manner in which it is fixed with staples to the beams above.

Wire lathing is coming into extensive use in New York and is favored by lower rates of fire insurance.

An Electric Railroad in Philadelphia.

President Edwards and the directors of the Ridge Avenue Passenger Railway Co., have given permission to the American Electric Railway Co. to lay a conduit and experimental line on Ridge avenue, from the depot at Dauphin street to Laurel Hill Cemetery. The work of laying the conduits and conductors for the electricity will begin in about a month. The American Co. was formerly known as the Bidwell Co., and during the Franklin Institute Electrical Exposition last fall, operated an experimental car and track, over which thousands of passengers took a short ride under the shed of the Pennsylvania Railroad Station on the east side of Thirty-second street. The reorganized company at first intended to lay its experimental tracks in order to demonstrate the applicability of the electric motive power in Fairmount Park, and obtained authority to this effect from the Commissioners, but subsequently the decision was made to lay down a conduit and establish a plant in connection with an existing street railway as a better means of demonstration to the public and those interested in electric railways. The Ridge Avenue Co. assented to the application.

The work will be under the supervision of W. M. Schlesinger, an English electrical engineer, who has studied the science in England, France and Germany. He states that Ridge avenue was chosen because of the peculiar grades, and in order to show the superiority of the new motor over horse-power in surmounting them in all weather.

The Electric Co. will next week start work on its shop and engine house. One car provided with a motor will be run at first, and this will not interfere with the trips of the regular horse-cars. The car will be one of the ordinary cars altered for the purpose, and will carry as many passengers as usual, the idea being to give the two motive powers a fair test, the claim being that the electrical is greatly the cheaper. The conduit will be laid so as to avoid interference with the travel of the horses, and the tracks will not be disturbed.

In shape the conduits will somewhat resemble those laid by the Traction Co., but will be of heavy timber, instead of iron, below ground. They will be braced inside with iron knees and provided with drainage facilities. Running along beneath the top will be the compound conductor of copper and iron, half circular in shape, well insulated and protected from damage from outside influences. On the top of the conduit forming each side of the slot, which will have a ½-in. opening, will be iron plates about 5 in. in breadth altogether. This slot opening will not be directly in the centre of the track, but to one side of the meridian line.

The current will be transmitted by an ingenious contrivance from the conductor underground to the motor in the car, and will be under instant control of the driver or engineer. At intervals of 18 ft. plates will be arranged over the conduit which may be readily removed for repairs and other work, and without removing the body of the conductor. The bottom of the conduit will be cemented previous to filling in the ground about it.—*Philadelphia Ledger, Aug.* 12.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Northern Pacific, annual meeting, at the office in New York, Sept. 17.

Ohio & Mississippi, annual meeting, at the office in Cincinnati, Oct. 8. Transfer books close Sept. 12.

St. Paul, Minneapolis & Manitoba, annual meeting, at the office in St. Paul, Minn., Aug. 20.

Terre Haute & Indianapolis, special meeting in Terre Haute, Ind., Aug. 16.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Cleveland & Pittsburgh (leased to Pennsylvania Co.), 1¾ per cent., quarterly, payable Sept. 1.

Illinois Central, 4 per cent., semi-annual, payable Sept. 1, to stockholders of record on Aug. 11.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be as follows:

The *Master Car-Painters' Association* will hold its annual convention in Toronto, Ont., on Wednesday, Sept. 2.

The *National Association of General Passenger & Ticket Agents* will hold its next half-yearly meeting in New York, at 11 a. m., on Tuesday, Sept. 15.

The *Brotherhood of Locomotive Firemen* will hold its annual convention in Philadelphia, on Monday, Sept. 21.

The *General Time Convention* will meet at the Grand Pacific Hotel, in Chicago, on Thursday, Oct. 8.

The *Southern Time Convention* will meet at the National Railway Exchange, No. 46 Bond street, New York, on Wednesday, Oct. 14.

Foreclosure Sales.

The *Texas Trunk* road will be sold at public sale in Dallas, Tex., Oct. 6, under a decree of the United States Circuit Court in favor of the International Trust Co., of New York. The road extends from Dallas, Tex., to Kaufman, 40 miles, and was recently sold at sheriff's sale and bought by local stockholders.

ELECTIONS AND APPOINTMENTS.

Austin & Northwestern.—Mr. A. N. Leitnaker has been appointed General Superintendent, in place of J. A. Rhomberg, resigned. Mr Peter Walker has been appointed Master Mechanic. The offices are in Austin, Tex.

Chicago & Western Indiana.—Mr. John T. Doom has been appointed General Roadmaster. He was recently on the Louisville, New Albany & Chicago road.

Cleveland & Mahoning Valley.—This company (whose road is leased to the New York, Pennsylvania & Ohio) has elected S. Burke President; J. H. Devereux, Vice-President; E. E. Poppleton, Secretary; E. R. Perkins, Treasurer.

Hannibal Union Depot.—Mr. Charles N. Lee is appointed Superintendent, to date from Aug. 17, in place of J. F. McDoel, resigned.

Kansas City & Southwestern.—Mr. E. B. Wingate is Chief Engineer. The general contractors are L. D. Latham & Co. Address, Winfield, Kansas.

Lake Erie & Western.—The following circular has been issued by General Passenger Agent G. W. Smith: "Mr. A. A. Jack has been appointed Eastern Traveling Agent, with headquarters at Cleveland, O., taking effect Aug. 1, 1885. His territory will consist of the trunk lines and their connections, east of the line of our road. Mr. John Bastable, Traveling Agent, with headquarters at Bloomington, Ill., will look after the business on the line of this road, on north and south cross lines, and on roads west of and tributary to our line."

Louisville, New Albany & Chicago.—Mr. L. C. Byrne has been appointed General Roadmaster, in place of Mr. J. P. Doom, who has gone to the Chicago & Western Indiana road.

Memphis & Little Rock.—Mr. T. E. Hastings has been appointed Auditor, in place of C. H. Dolbeer, resigned. Mr. M. S. Jay has been appointed General Agent at Memphis, in place of James Harrington, resigned.

Missouri Pacific.—Superintendent E. K. Sibley makes the following announcements: The office of Train-master of the Missouri, Kansas & Texas, north of Parsons, and the office of Assistant Superintendent of the Missouri, Kansas & Texas Railway (north of Denison) are abolished. Mr. J. J. Frey is appointed Division Superintendent of the Missouri, Kansas & Texas and branches, north of Parsons, and will also assume the duties heretofore performed by the Train-master, with office at Sedalia, Mo. Mr. T. G. Golden, with the title of Division Superintendent, will be continued in charge of that portion of the road between Junction City and Denison,

including the Parsons yard, with office at Parsons, Kan. The office of Assistant Superintendent at Kansas City is abolished. Mr. F. B. Drake is appointed Assistant Superintendent of the Missouri Pacific and of the Missouri, Kansas & Texas (north of Denison), with office at Sedalia, Mo. Mr. M. C. Straight is appointed Division Superintendent of the Western Division of the Missouri Pacific, with office at Kansas City. He will have charge of train and station men and perform the duties heretofore performed by Mr. F. B. Drake, Assistant Superintendent. Mr. Samuel Phillips, Second Assistant General Freight Agent, having resigned, that office has been abolished.

New Brunswick.—At the annual meeting in St. John, N. B., Aug. 4, the following directors were chosen: Alexander Baring, E. R. Burpee, Lord Elphinstone, D. Willis James, John S. Kennedy, H. O. Northcote, Donald A. Smith, George Stephen, Samuel Thorne, J. Kennedy Tod, C. W. Weldon. The only new director is Mr. Weldon, who succeeds Isaac Burpee, deceased. The board elected Samuel Thorne President; J. Kennedy Tod, Vice-President; F. W. Cram, General Manager; Alfred Seely, Secretary and Treasurer.

Pontiac, Oxford & Port Austin.—Mr. James Houston, General Superintendent, will act for the present as General Freight and Passenger Agent, in place of C. C. Jenkins, resigned.

St. Joseph & Western.—Mr. D. McCool has been appointed General Manager of this road, and will take charge of the road Sept. 1. Mr. McCool has been for several years past General Manager of the Detroit, Mackinac & Marquette road.

St. Louis, Alton & Terre Haute.—The following circular from Vice-President and General Manager George W. Parker is dated St. Louis, Aug. 3:

"Mr. P. H. Murphy has been appointed Master Mechanic of the roads operated by this company, vice Mr. R. M. Pringle, resigned. Appointment will take effect at once. Mr. Murphy will have charge of the rolling stock, shops and machinery of the company, with headquarters at East St. Louis, and his authority will be respected accordingly."

Sonoma Valley.—The directors of this company are Peter Donahue, James M. Donahue, Arthur Hughes, T. W. Johnson and R. H. Lloyd. The office is in San Francisco.

Superior & Southwestern.—The directors of this new company are: C. L. Catlin, J. H. Hammond, W. V. Nood, West Superior, Wis.; G. W. Cumming, Joseph Kling, St. Paul, Minnesota.

Toledo, Cincinnati & St. Louis.—Mr. B. S. McLeod has been appointed Master of Transportation, with office at Frankfort, Ind. He was recently on the Chicago & Grand Trunk road.

PERSONAL.

—Mr. J. F. McDoel has resigned his position as Superintendent of the Hannibal Union Depot.

—Mr. R. M. Pringle has resigned his position as Master Mechanic of the St. Louis, Alton & Terre Haute road.

—Mr. E. M. Reynolds has resigned his position as General Passenger Agent, Auditor and Purchasing Agent of the Cincinnati, Van Wert & Michigan road.

—Mr. A. L. Rowe is now General Agent of the Mississippi Glass Co. of St. Louis. He has for some time past represented the Pickering Spring Co., of Philadelphia.

—Mr. D. McCool has resigned his position as General Manager of the Detroit, Mackinac & Marquette road, to take charge of the St. Joseph & Western. Mr. McCool has had charge of the Detroit, Mackinac & Marquette ever since its completion.

—Col. George L. Perkins, of Norwich, Conn., treasurer of the Norwich & Worcester Railroad Co., celebrated his 97th birthday Thursday of last week by going to the seashore with his wife of 86. He is erect in carriage, jaunty and active. Ten years ago he testified in the Beecher trial, and electrified the court, when asked how long he had lived in Norwich, by replying, "Eighty-seven years, sir." William M. Evarts, who was examining the witness, was floored for a moment, and finally said, "May I venture to inquire, Col. Perkins, where you spent the rest of your life?"

TRAFFIC AND EARNINGS.

Omaha Bridge Tolls.

The agreement between the Union Pacific and its Eastern connections at Council Bluffs by which the freight rates to Omaha are made the same as to Council Bluffs on condition of certain concessions on bridge-toll charges by the Union Pacific, is as follows: "That the lines terminating at Council Bluffs make the Omaha rate the same as Council Bluffs to and from Chicago and common points and Missouri River points, allowing the Union Pacific $4 per car on freight in car-loads regardless of weight, 3 cents per 100 pounds for freight in less than car-loads, with a maximum of $4 for mixed car-loads between Council Bluffs, Omaha, South Omaha and Union Stock Yards, in effect after June 1, to apply on all freight consigned to or shipped from Omaha proper; the Union Pacific to perform necessary terminal service at above points, including switching, billing, receiving and delivering of freight and furnishing necessary depot facilities."

Boston Traffic Notes.

There were hauled east through the Hoosac Tunnel last month 6,586 loaded and 224 empty cars, against 6,799 loaded and 240 empty cars in July, 1884, or a decrease of 213 loaded and 16 empty cars.

Cotton.

Cotton movement for the week ending Aug. 7 is reported as follows, in bales:

	1885.	1884.	Inc. or Dec.	P.c.
Interior markets:				
Receipts	2,904	2,345	I. 559	24 2
Shipments	2,227	4,255	D. 2,028	47.2
Stock, Aug. 7	21,255	20,433	I. 822	4.0
Seaports:				
Receipts	2,038	2,263	D. 225	9.9
Exports	13,955	16,452	D. 2,497	15.1
Stock, Aug. 7	191,075	189,483	I. 1,592	0.8

The total shipments from plantations for the cotton year (from Sept. 1) to Aug. 7 are estimated at 5,614,634 bales, against 5,649,007 last year, 6,955,229 in 1882-83, and 5,343,732 bales in 1881-82.

Texas Traffic Association.

Governor Ireland, of Texas, has addressed the following letter to the Attorney-General of the state:

"I call your attention to a late act of the Legislature, demanding action against railway companies to prevent and break up consolidations of competing lines. I also call your attention to the late conference in Galveston between the owners of main lines in Texas. It is now understood that the main offices of some of the principal lines are to be, or are being removed out of the state. There is no doubt that each main road in Texas is a competing line to every other road in this state, and that no consolidation can take place without violating the constitution and laws. I hope you will not delay action in these matters, and that the railway companies may be required to conform their action to the constitution and laws."

Negotiations have been renewed in New York between the Gulf, Colorado & Santa Fe, the Gould and the Huntington lines. At present it appears quite probable that the proposed pool will be formed under a five years' contract, terminable after one year on 60 days' notice.

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

	1885.	1884	Inc. or Dec.	P.c.
Seven months to July 31:				
Boston, Hoosac Tun. & W.	$251,189	$240,320	I. $10,869	4 5
Bur., C. R. & No.	1,638,299	1,474,678	I. 163,621	11 1
Canadian Pac.	4,242,827	2,647,411	I. 1,595,416	60 3
Central Iowa.	651,396	779,203	D. 127,807	16.4
Chi., St. P., Min. & Omaha	2,974,732	3,160.309	D. 185,577	6.0
Chi. & W. Mich.	714,620	889,095	D. 174,475	19.4
Cin., Ind., St. L. & Chi.	1,318.730	1,299.124	I. 19,606	1.5
Denver & R. G.	3,235,857	2,516,960	I. 348,897	11.9
Denver & R. G. Western	519.846	407.841	I. 112,005	27.5
Det., Lan. & No.	642,183	776.937	D. 134,754	17.3
Ev. & T. Haute	409,090	407,974	I 1,116	0 3
Flint & Pere M.	1,082,702	1,383,863	D. 301,161	21.8
Grand Trunk	8,534,735	9,612,544	D. 1,077,809	11.1
Illinois Central	5,862,215	5,487.811	I. 374 404	6.8
Iowa lines	872,239	928,707	D. 56,468	6.1
Kansas City, Ft. Scott & Gulf	1,435,192	1,325,837	I. 109,355	8.2
Kan. City, Spr. & Mem.	927,282	627,624	I. 299,658	47.7
Mexican Central.	2,148,696	1,611,303	I. 537.393	33.4
Mobile & Ohio	1,041,775	1,105,709	D. 63,934	5.8
Norfolk & West.	1,424,427	1,424,404	I. 23	..
Peoria, Dec. & E.	379,791	420,093	D. 40,302	9.6
Rich. & Dan.	2,124.573	2,076.025	I. 48.548	2.3
Roch. & Pitts.	662 960	609,235	I. 53,725	8.8
St. P. & Duluth.	619,491	613,107	I. 6,384	1.1
St. P., M. & Man.	3,674,375	4,290.107	D. 615,732	14 4
Wab., St. L & P.	7,830,658	8,683,156	D. 852,498	9.8
Wisconsin Cent.	805,661	794,073	I. 11,588	1.4
Six months to June 30:				
Albany & Sus.	$1,053.192	.....	.....	....
Net earnings.	344.389	.....	.....	....
Boston & Albany.	3,507,414	$3,662,120	D. $154,706	4.2
Net earnings	933,924	1,087,161	D. 153,237	14 1
Ches. & Ohio	1,566.415	1 711.205	D. 144,790	8 5
Net earnings	367 984	444,324	D. 76,340	17.4
Ches , O. & S. W.	701,625	610,974	I. 90,651	14.8
Net earnings	179,353	84,966	I. 94.387	111.0
E. Ten., Va. & G.	1,751,127	1,864.278	D. 113,151	6 1
Net earnings	505,560	627.862	D. 122.302	19.3
Eliz., Lex. & B. S.	316,008	322,961	D. 6,953	2.1
Net earnings	86,583	75,220	I. 11,363	13 4
Kentucky Cent.	383,492	377,169	I. 6,323	1.7
Net earnings	88,305	99,108	D. 10,803	10.9
Long Island	1,174,663	1,134,973	I. 39,687	3 5
Net earnings	348,658	345,953	I. 2,725	0.8
N. Y. Central & Hudson River	11,565,856	13,071,662	D. 1.505 806	11.5
Net earnings	3,679,778	4,620,511	D. 940,733	20.4
N. Y., New Haven & Hart.	3,188,859	3,190,691	D. 1,862	0.1
Net earnings	1.372,735	1.198 461	I. 174,274	14.5
Northern Pacific.	4,606,430	5,985,586	D. 1,379.156	23.0
Net earnings	1,920,780	2,760,405	D. 839,625	30 4
Rensselaer & Sar.	884,023	.....	.....	....
Net earnings	233,689	.....	.....	....
Month of June:				
Denver & R. G.	$525.342	.....	.....	...
Net earnings	176.937	.....	.....	...
E. Ten., Va. & G.	274,475	$307,810	D. $33,335	10.8
Net earnings	66,715	88,966	D. 22,249	25.0
Northern Pacific.	1,012,507	1,143,123	D. 130,616	11.4
Net earnings	504,887	535,895	I. 28,992	5 4
Month of July:				
Boston, Hoosac Tun & W.	$41,468	$43,011	D. $1,543	3 6
Bur., C. R. & No.	224,380	195,969	I. 28,411	14 5
Canadian Pacific.	890,000	572,000	I. 318,000	55.6
Central Iowa.	85,965	96,322	D. 10,357	10.8
Chi., St. P., M. & Omaha	468,800	467,100	I. 1,700	0.4
Chi. & W. Mich.	112,719	123,883	D. 11,164	9.0
Cin., Ind., St. L & Chi	170.922	209.515	D. 38,593	18 4
Denver & R. G.	548,295	400,400	I. 147,895	36 9
Denver & R. G. Western.	90,000	45,712	I. 44,288	96.9
Det., Lan. & No.	92,937	97,903	D. 4.966	5.1
Ev. & T. Haute	66,066	73,422	D. 7,356	10.0
Flint & Pere M.	151,469	171,248	D. 19 779	11.6
Grand Trunk	1,408,177	1,625,156	D. 216,979	13.4
Illinois Central.	723,777	704.232	I. 19 545	2 8
Iowa lines.	129,577	127,718	I. 1,859	1.5
Kansas City, Ft. Scott & Gulf	172,438	176,239	D. 3,801	2.1
Kan. City, Spr. & Mem.	95,824	92,871	I. 2,953	3.2
Lake Erie & W.	74,781	76,356	D. 1,575	2.0
Mem. & Charles.	86.705	102,696	D. 15,991	15.5
Mobile & Ohio	118 293	129,323	D. 11,030	8.5
Norfolk & West	187,397	177,902	I. 9,495	5.3
Oregon R. & N. Co	408,000	328,000	I. 80,000	24 4
Net earnings	195 000	95,000	I. 100,000	10.5
Peoria, Dec. & E.	53,371	54,783	D. 1,412	2.6
Rich. & Dan.	269,000	250,923	I. 18,077	7.2
Roch. & Pitts.	110,895	109.945	I. 950	0.9
St. P. & Duluth.	141,855	119.500	I. 22,355	18.6
St. P., M. & Man.	553.347	605.156	D. 51,809	8.6
Wab., St. L. & P.	932,678	1,234,298	D. 301,620	24.4
Wisconsin Cent.	114,565	107,794	I. 6,771	6.3
First week in August:				
Chi. & Alton	$165,919	$191,614	D. $25,695	13.4
Chi. & East. Ill.	30,410	37.577	D. 7,167	18.9
Chi., Mil. & St. P.	393,000	408,803	D. 15,803	3 9
Chi. & Nor'west.	439,500	427,900	I. 11,600	2.7
Cin., Ind., St. L. & Chi.	41,730	56,334	D. 14,604	26.2
Illinois Central.	173,700	171,028	I. 2,672	15.6
Iowa lines	23.600	24,314	D. 714	0.3
Roch. & Pitts.	22,977	25,413	D. 2,436	9 6
St. L. & San F.	74,500	95,700	D. 21,200	22.1

Weekly earnings are usually estimated in part, and are subject to correction by later statements. The same remark applies to early statements of monthly earnings.

Coal.

Anthracite coal tonnage for the week ending Aug. 8 was 607,055 tons, against 845,848 last year, a decrease of 238,793 tons, or 28.3 per cent. For the year to Aug. 8 the weekly reports make a total of 16,135,000 tons.

The coal tonnage of the Chesapeake & Ohio Railroad for the seven months to Aug. 1 was:

	1885.	1884.	Increase.	P. c.
Coal	640,668	493,654	147.014	29.8
Coke	68,969	34,449	34,520	100.2
Total	709,637	528,103	181,534	34.4

The increase this year has been in all classes, but especially in the New River and other steam coals.

Bituminous coal tonnages for the seven months to Aug. 1 were:

	1885.	1884.	Inc. or Dec	P. c.
Cumberland, all lines	1,549,070	1,582,893	D. 33,823	2.1
Huntingdon & Broad Top	94.313	110.668	D. 16,355	14.8
Barclay R. R. & Coal Co.	136,688	183,298	D. 46.610	25.5
Pennsylvania R. R:				
Clearfield	1,732,766	1,799,568	D. 66 802	3.7
Penn and Westmoreland	646,181	745,808	D 99,627	13.3
Minor districts	902,477	807,760	I. 94.717	11.7
Total	5,061,495	5,229,995	D.168,500	3.2

A slight falling off in tonnage is here shown, which is general in all the districts except the smaller ones on the Pennsylvania Railroad.

Coke tonnages for the seven months to Aug. 1 were:

	1885.	1884.	Inc. or Dec.	P. c.
Southwest Penna. R. R.	1,127,748	1,295,622	D. 167,874	12.9
Other districts, Pa. R. R.	343,061	283,555	I 59,506	20.9
Connellsville, *via* Pa. R. R.	35.846	205,329	D. 169,483	82.7
Total	1 ,506,655	1,784,506	D. 277,851	15.6

Coke shipments continue to show a large decrease from last year. The reports given are from the Pennsylvania Railroad only, but the indications are that the figures of the other coke-carrying companies would, if published, show a very considerable falling off from last year also.

Anthracite coal shipments of the Shamokin Division, Northern Central Railway, for the seven months to Aug. 1 were, this year, 526,596; last year, 572,875; decrease, 46,279 tons, or 8.1 per cent.

The coal tonnage of the Pennsylvania Railroad Division of the Pennsylvania Railroad for the seven months to Aug. 1 was:

	1885.	1884.	Inc. or Dec.	P. c.
Coal	6,197,664	5,875,736	I. 321,928	5.6
Coke	1,479,598	1,770,053	D. 290.455	16.4
Total	7,677,262	7,645,789	I. 31,473	0.4

This includes all tonnage passing over the road, whether originating on the line or received from other lines.

The Southwest Virginia Improvement Co. shipped from its mines on the Norfolk & Western road, in June, 37,400 tons; for the six months to June 30 shipments were 231,785 tons, a large increase over last year.

Cumberland coal shipments for the seven months to July 31 are given by the Cumberland *Civilian* as follows:

	1885.	1884.	Inc. or Dec.	P. c.
Balt. & Ohio R. R.	1,137,015	1,188,182	D. 51,167	4.3
Bedford Div., Penn R. R.	238,053	233,571	I. 4,482	1.9
Chesapeake & Ohio Canal	174,002	161,140	I. 12,862	8.0
Total	1,549,070	1,582,893	D. 33,823	2.1

Shipments from mines for the same period were: Cumberland & Pennsylvania, 1,010,037; George's Creek & Cumberland, 307,179; West Virginia Central & Pittsburgh, 235,184; total, 1,552,400 tons. Local deliveries are included in the tonnage credited to the Baltimore & Ohio above.

The coal tonnage of the Pennsylvania Railroad for the week ending Aug. 8 was:

	Coal.	Coke.	Total.	1884.
Line of road	125,582	52,892	178,474	193,528
From other lines	74,686	961	75,647	68,969
Total	200,268	53,853	254,121	262,497
Year to Aug. 8	6,397,932	1,533,451	7,931,383	7,908,286

Decrease for the week, 8,376 tons, or 3.2 per cent.; increase for the year, 23,097 tons, or 0.3 per cent.

Cumberland coal shipments for the week ending Aug. 9 were 47,990 tons. Total to Aug. 9 this year, 1,597,060; last year, 1,638,887; decrease, 41,827 tons, or 2.5 per cent.

New Passenger Lines.

The following circular from the passenger department of the Louisville & Nashville road explains itself; it is dated Louisville, Ky., Aug. 1, 1885:

"By the terms of the traffic contract entered into Oct. 1, 1881, between the Louisville & Nashville Railroad Co. and the East Tennessee, Virginia & Georgia Railroad Co., the latter company is granted the right to place its issue of tickets on sale on the Louisville & Nashville Railroad at the following points south of Calera, namely: New Orleans, Mobile and Montgomery. The territory included in said contract is to Cincinnati, O., and points east thereof, but to no points west thereof; over the South & North Alabama Railroad *via* Decatur to the west by the Memphis & Charleston Railroad, and its western connections, but to no point north of the state of Tennessee. It is also granted the right by the Louisville & Nashville Railroad Co. to participate in the formation of through rates from these points to the territory above described, provided the same are not less than 2 cents per mile per capita on first-class tickets, and 1 cent per mile on emigrant tickets.

"The East Tennessee, Virginia & Georgia Railroad Co. having claimed its rights under this traffic contract, it becomes an independent line between the points mentioned and the territory east of Calera and Cincinnati."

A Day's Travel on the New York Elevated Roads.

The Manhattan Co. reports that the number of passengers carried on the New York elevated roads on Saturday, Aug. 8—the day of Gen. Grant's funeral—was:

Second Avenue line	36,150
Third Avenue line	143,865
Sixth Avenue line	179,626
Ninth Avenue line	40,435
Total	400,076

The Third Avenue is usually the line of heaviest travel, but on this occasion the Sixth took the lead, for the reason that it is the line running to Riverside Park and generally following nearly the line of the procession. Of course, the great bulk of the travel came within a few hours, and for some time trains were run just as close together as possible—about one minute apart. This vast number of passengers was carried without accident of any kind.

This is the largest number of passengers ever carried by these roads in a single day. The heaviest day previously was the day of the Brooklyn Bridge opening, when 389,501 persons were carried, which is 10,575 less than on Saturday last.

OLD AND NEW ROADS.

Anglesea.—Work has been begun on an extension of this road from its present terminus at Anglesea, N. J., to Holly Beach, a distance of 3 miles. The road is a short branch of the West Jersey, running from that road at Anglesea Junction to Anglesea on the ocean beach, a distance of 4 miles.

Atchison, Topeka & Santa Fe.—This company's Southern Kansas line is now completed to Kiowa, in Barbour County, Kan., 8 miles beyond the late terminus, 22 miles beyond the old terminus of the old line at Attica, and 338 miles from Kansas City. Trains have begun to run to the new terminus.

The Montezuma Hotel at Las Vegas Springs, N. M., which is owned by this company, caught fire on the night of Aug. 8, and a large part of the building was destroyed, causing a

loss of nearly $200,000. Part of the furniture was saved, and the guests were provided for in the cottages belonging to the hotel and other adjoining buildings. This structure which has just been destroyed was a very handsome one, and was built to take the place of the first hotel, which was destroyed by fire 18 months ago.

Baltimore & Ohio.—The grading of the Philadelphia extension is now practically completed from Baltimore within about 3 miles of the Schuylkill River. On this section of 3 miles a large force is now at work, and the road will probably be completed in a short time. The work of building the foundation for the piers of the Schuylkill River bridge is being rapidly pushed, and the first caisson is nearly ready to be put in place. The bids for the work in the city east of the Schuylkill River have all been examined, and it is expected that the tracks will be built very shortly—possibly this week.

The latest report is that the New York Central and the Pennsylvania have opened negotiations with this company, and that inducements have been offered to the company to give up the extension of its line to New York.

Boston & Albany.—This company's statements to the New York Railroad Commission give the following figures for the quarter ending June 30 and the nine months of the fiscal year from Oct. 1 to June 30:

	Quarter.		Nine months.	
	1885.	1884.	1884-85.	1883-84.
Earnings	$1,833.666	$1,910,423	$5,522,673	$5,804,266
Expenses	1,416,727	1,394,966	3,859,710	4,027,820
Net earnings	$416,939	$515,457	$1,662.963	$1,776,437
Int., rents, etc.	188,071	187,971	1,072,702	1,130.950
Surplus	$228,868	$327,486	$590,261	$645,487

For the nine months this shows a decrease of $281,593, or 4.8 per cent., in gross earnings; of $113,474, or 6.4 per cent., in net earnings, and of $55,226, or 8.6 per cent., in surplus.

Buffalo, New York & Philadelphia.—Reports have been current that the Pennsylvania Railroad Co. was making arrangements to secure control of this road. The only basis there appears to be for this statement is that for some time past the Pennsylvania has considerably increased the tonnage shipped to Buffalo, which passes over this company's line from Emporia, Pa., to Buffalo. A large part of this increase in traffic is in coal.

Carson & Colorado.—This company will shortly begin work on an extension of its line from Owen's Lake, Cal., through the Panamint Valley to Mojave, where it will connect with the Southern Pacific.

Chicago, Burlington & Quincy.—This company has completed and opened for business the new Western Iowa Branch, which runs from Fontanelle, Ia., to Cumberland, 23 miles. This road has been under construction for some time, and is, it is supposed, the commencement of a new cut-off line to Council Bluffs.

Chicago & Eastern Illinois.—In the matter of the application of Merriman and others, judgment creditors of the old Chicago, Danville & Vincennes Co., to set aside the foreclosure and sale under which the road passed to the present company, the United States Court has set aside the demurrer interposed to the bill. The Court holds that the defendants in the suit must answer the allegations of collusion and fraud contained in the bill. The demurrer is therefore set aside and defendants are required to file an answer to the complaint.

This company has filed a bill in equity, asking to have the Chicago & Western Indiana, the Wabash and the Chicago & Grand Trunk enjoined from doing local business over the Chicago & Western Indiana tracks. The Chicago & Western Indiana was originally built in the interest of the Chicago & Eastern Illinois, and was leased by that company, and the bill claims that when the other roads were admitted to Chicago on the Western Indiana tracks there was an agreement that the local business should remain with the Eastern Illinois Co. This agreement, the bill charges, has been disregarded by the other companies, and an injunction is therefore asked in order to enforce the contract.

Chicago, Rock Island & Pacific.—A somewhat doubtful report comes from Chicago to the effect that this company has obtained control of the Northern Pacific. It needs confirmation

Denver & Rio Grande.—Receiver Jackson reports to the Court that the gross earnings of the road for June were $525,342. The expenses were $343,405, and the net earnings $176,937. During the month the sum of $18,999 was paid out for improvements of the road and $3,963 for hire of equipment.

East Tennessee, Virginia & Georgia.—Some of the bondholders have obtained an opinion from counsel to the effect that the Knoxville & Ohio Co. cannot legally issue first-mortgage bonds on its road as proposed, for the reason that the property is already covered by the consolidated mortgage of the East Tennessee, Virginia & Georgia Co. Under this advice it is stated that the payment of any interest on the proposed issue of Knoxville & Ohio bonds will be contested by the consolidated bondholders.

East Tennessee, Virginia & Georgia.—This company's statement for June and the fiscal year ending June 30 is as follows:

	June.		Year.	
	1885.	1884.	1884-85.	1883-84.
Earnings	$274,475	$307,810	$3,880,470	$4,173,265
Expenses	207,758	218.844	2,519,871	2,473,340
Net earnings	$66,717	$88 966	$1,360,599	$1.699,925

For the year the decrease in gross earnings was $292,795, or 4.1 per cent., and the increase in expenses $46,531, or 1.9 per cent., leaving a decrease of $339,326, or 14.1 per cent., in net earnings.

Fitchburg.—The Boston *Advertiser* of Aug. 11 says: "Trains began last week to run over the double track iron bridge which the Fitchburg road has been for several months erecting across the Connecticut River near Montague station, three miles east of Greenfield. In this substantial piece of work there is a fine and unusually large example of pin-jointed truss structure. The length is among the first in New England, though surpassed on the Connecticut by two or three bridges farther down the stream. There are three spans of 180 ft. each, and two of 50 each, making the total length 640 ft. The depth of the truss is 28 ft., and it stands 70 ft. above the water. Like every other bridge except one on the Fitchburg road, this is of the deck pattern, the track being on top, with the bracing underneath. The material was furnished ready to put together by the Boston Bridge Co., and has been set in place by the Fitchburg Co., under the supervision of Chief Engineer Turner. The parts of the structure were manufactured in three separate places, and were not assembled until brought upon the ground, and it is worthy of note as a remarkable achievement in bridge building that they went together perfectly without a particle of special fitting. This degree of excellence in workmanship was unknown a few years ago. The masonry was furnished by A. H. Wright and George E. Lyons, of Greenfield. The new bridge takes the place of a single track wooden bridge 12 ft. lower, which has been in use, with some strengthening, ever since the opening of the branch of the old Vermont & Massachusetts road from Miller's Falls to Greenfield, 34 years ago. The cost of the work, including the approaches, has been about $100,000. A mile nearer Greenfield work has begun on the foundations for a similar bridge to span the Deerfield. On its completion the entire main line of the Fitchburg road' with the exception of about half a mile beyond the second bridge mentioned, will have a first-class double track."

Georgia Midland & Gulf.—Subscriptions continue to be received along the line for the construction of this projected line from Columbus, Ga., to Atlanta, and a considerable amount has been received, Columbus alone raising $150,000. Much local interest is felt in the project, especially in Atlanta, as it is known that it is the intention of the Northeastern Railroad Co., which is controlled by the Richmond & Danville, is, if possible, to have the line built from Columbus to Athens, instead of to Atlanta. The object of this is easily understood, as, if the road should go to Athens, its only outlet would be over the Richmond & Danville, while, if it goes to Atlanta, it will have the choice of all the railroads centring in that city. The line will pass through a rich cotton country, and will furnish an outlet to a considerable section of the state which is now either without railroad facilities or is entirely dependent on the Central Railroad.

Housatonic.—This company has modified its classification of freights and made some changes in the rates to meet the objections made by shippers on the line. This is done in advance of any positive action on the part of the Massachusetts Railroad Commission to enforce its recent orders, and the company promises a further revision after trial of the present one, so as to avoid, if possible, any positive action. This course is satisfactory to all parties, as the Board would much prefer that the company would conform to its recommendation without making it necessary to take legal action.

Houston & Texas Central.—The Receivers make the following statement for the three months ending May 31:

1885.	Gross	Expenses.	Net earnings.
March	$151,175	$139,123	$12 052
April	127,802	126,159	1,643
May	124,610	131,830	*7,221
Total	$403,587	$397,112	$6,474
1884.			
March	$192.440	$133,871	$58,569
April	159,326	123.276	36,050
May	146,286	121,669	24,617
Total	$498,052	$378,816	$119,236

* Deficit.

Comparing these results, there has been a decrease in the gross earnings of $94,464; an increase in the operating expenses of $18,296, owing to increased renewal of cross-ties over last year, and a decrease in the net transportation earnings of $112,761. The operations of the road since the appointment of the Receivers on Feb. 23, to May 31, 1885, are summarized as follows:

Transportation receipts		$385,644
Miscellaneous "		808
Total		$386,452
Working expenses	$399,572	
Taxes	50,131	
Betterments	6,123	
Interest and principal, state debt	19,645	
		$475,471
Deficit		$89,019

The liabilities of the Receivers on May 31 were:

Receivers' certificates issued		$297,858
Unpaid accounts of the Receivers		229,045
Due Trustees' account of land sales		53,221
		$580,124
Assets:		
Accounts due them	$150,208	
Cash on hand	267,095	
Cash, land fund account	51,040	
		468 343
Deficit in assets as compared with liabilities		$111,781

In addition to the above the Receivers have paid for account of the old indebtedness the sum of $86,591, and have received supplies used by the Receivers in the current operations of the road, $26,405. There has been collected also for rent of grazing lands (a large portion of the annual rental becoming payable during this period of the year) the sum of $37,985. No interest on bonds has been included in either of the above statemehts.

Intercolonial.—As heretofore noted, the contract between the Intercolonial Railway and Pullman's Palace Car Co. expired Aug. 1, and was not renewed. As provided for by the contract, the Intercolonial Railway purchases the 10 Pullman cars which have been running on the line, and they will hereafter be operated by the railroad. Several of these cars are new, and all of them in good condition, and they will be run between St. John, Halifax and Montreal, as heretofore.

Kansas City & Southwestern.—This company was organized last year to build a railroad from Kansas City, by way of Burlington, Eureka and Winfield, to the Indian Territory line beyond Arkansas City, with a branch to Caldwell. Work has been in progress for some time on the section from Beaumont, Kan., on the St. Louis & San Francisco road, to Winfield, 69 miles, and track is now laid from Beaumont southwest 38 miles, while the grading and bridging are nearly finished to Winfield. The road is to be operated as an independent line.

Lake Superior & Southwestern.—This company has been organized to build a railroad from West Superior, Wis., by St. Croix Falls, to Menominee, a distance of about 160 miles.

Long Island.—This company's statement to the New York Railroad Commission for the quarter ending June 30 is as follows:

	1885.	1884.	Inc. or Dec.	P.c.
Earnings	$717,948	$695.175 I.	$22,773	3.3
Expenses	449,199	405,842 I.	43.357	10.7
Net earnings	$268,749	$289,333 D.	$20 584	7.1
Other income	17,916	72,648 D.	54,732	75.0
Total	$286,665	$361,981 D.	$75,316	20.8
Charges	162,835	163,222 D.	387	0.2
Surplus	$123,830	$198,759 D.	$74,929	37.7

A dividend of 1 per cent. was paid for the quarter, requiring $100,000 and leaving a surplus of $23,830.

Los Angeles & San Gabriel Valley.—Tracklaying is now in progress on this road, and the construction train has reached Pasadena, 10 miles from Los Angeles. Work is being pushed forward steadily, and the company hopes to have at least 25 miles in operation this year.

Louisville & Nashville.—The new bridge over the Ohio River at Henderson, Ky., was formally opened Aug. 5, when there was a grand celebration in Henderson. The bridge was projected a number of years ago, when the St. Louis & Southeastern road was first built, but no work was done on it until after the road had passed into possession of the Louisville & Nashville. Work was begun on the foundations in 1882, but numerous delays intervened and it was not actively prosecuted until 1884. It was built under charge of F. W. Vaughn, Chief Engineer, and O. F. Nichols, Resident Engineer. The total cost of the bridge has been about $1,600,000, and has been built by an independent company, all the stock of which is owned by the Louisville & Nashville. It completes the through rail connection between St. Louis & Nashville, which has heretofore been interrupted by the long ferry transfer between Evansville and Henderson, and under the new schedule, which took effect on the opening of the bridge, the time of trains from St. Louis and Chicago to Nashville has been reduced about 6 hours.

Louisville, New Orleans & Texas.—This company is about to place orders for 10 new locomotives and 300 box cars, to be delivered in time for use in the busy season.

Macon & Dublin.—At a recent meeting of the directors of this road it was resolved to begin work at once on the grading of the first section of 10 miles, beginning at Dublin, in Lawrence County, Ga., and running west by north from that place. The work is to be done by convict labor, under the immediate supervision of the company's chief engineer.

Maine Shore Line.—This project, which has been at a standstill for several years, has been revived and efforts are being made along the line to secure subscriptions and donations of right of way, thus far with considerable success. Part of the line was built last year by the Maine Central as its Mt. Desert Branch. The line as originally projected was to run from Bangor to Eastport. The Maine Central having constructed, as noted above, a part of the road, it is now proposed to leave that company's line at Hancock and build eastward through the shore towns to Calais and Eastport.

Memphis & Charleston.—Vice-President Calvin S. Brice is reported as saying: "The suit for the cancellation of the lease to the East Tennessee, Virginia & Georgia Co. is progressing, and in due time a decree canceling the lease will be entered, and from that time on the Memphis & Charleston Railroad will be operated as an independent corporation for the benefit of its bond and stock holders solely. This is quite independent of the question whether any portion of the stockholders, whether a majority or not, sell their stock to East Tennessee, Virginia & Georgia, the plan for which has been talked of, but has not been consummated. No matter whether General Thomas or myself retain our interest in the stock or transfer it to the East Tennessee Co., the Memphis & Charleston Railroad will be operated for the benefit of all its security holders without discrimination or preference."

A meeting of the stockholders opposed to the sale of this road to the East Tennessee, Virginia & Georgia Co. has been called for Aug. 20.

Mexican Central.—The gross and net earnings for June and for six months from Jan. 1 were as follows:

	June		Six months.	
	1885.	1884.	1885.	1884.
Gross earnings	$278.770	$247,248	$1,880,495	$1,379,103
Operating expenses.	179,286	204,194	1,046,497	1,236,539
Net earnings	$99,484	$43,054	$833,998	$142,864

For the half year the earnings increased $501,092, or 36.3 per cent., and the expenses decreased $190,042, or 15.4 per cent.; the result being a gain of $691,132, or 483.8 per cent., in net earnings.

New York Central & Hudson River.—This company's statement for the quarter ending June 30 and the nine months of the fiscal year from Oct. 1 to June 30 is as follows:

	Quarter.		Nine months.	
	1885	1884	1884-85.	1883-84.
Earnings.	$5,603,634	$6,361,071	$18,376,026	$20,985,790
Expenses	3,878,863	4,232,258	11,819,165	13.132,950
Net earnings	$1,724,771	$2,128,813	$6.556,861	$7,852,840
Int., tax. and r's	1,485,000	1,395,000	4,470,000	4,185,000
Surplus	$239,771	$733,813	$2,086.861	$3,667,840
Dividends paid.	447,142	1,788,566	2,682,849	5,365,698
Deficit	$207,371	$1,054,763	$595,988	$1,697,858

For the nine months the decrease in gross earnings was $2,609,764, or 12.4 per cent.; in net earnings $1,295,979, or 16.5 per cent., and in surplus $1,580,979, or 43.1 per cent.

The working expenses this year were 69.2 per cent. of gross earnings for the quarter and 64.3 per cent. for the nine months, against 66.5 and 62.6 per cent. last year. Dividends paid were 0½ per cent. for the quarter and 3 per cent. for the nine months this year, the surplus earned being 0.27 per cent. on the stock for the quarter and 2.33 per cent. for the nine months. Last year the company paid 2 per cent. for the quarter and 6 for the nine months, the surplus being 0.82 and 4.11 per cent. respectively.

In the current nine months the amounts received and paid for car mileage are not included in earnings and expenses respectively as last year, but the excess of payments over receipts, being the debit balance in the account, has been charged to operating expenses.

New York, Chicago & St. Louis.—The first mortgage bondholders' committee have issued a circular containing a statement of what they have done up to the present time. Th ecommittee has employed counsel and has intervened in the suit brought under the second mortgage. In this suit it has secured the appointment of a master to determine the ownership of the equipment. It has resisted the issue of receiver's certificates or any other obligation which may go in ahead of the first mortgage, and proposes continuing that course of action. The committee has also continued its efforts to secure some settlemeet in the interest of the bondholders. Should no such settlement be reached by Sept. 1, when the first mortgage coupons will have been three months in default, further legal proceedings will be begun at once. In short, the intention of the committee is to concede none of the legal right of the bond holders whom it represents, and to resist any plan of settlement which does not concede to them a priority in their interest. The committee represents already a large amount of bonds, but, in order to secure its object, desires to control three-fourths of the entire amount, as with that number in hand it is believed that a satisfactory settlement can be enforced.

New York, Lake Erie & Western.—An arrangement has been made by which trains on this company's leased New York, Pennsylvania & Ohio road will hereafter be run through the city of Springfield, O. A connecting switch has been put in at a point called Shattuc Junction, and trains will run thence over the Indiana, Bloomington & Western track, through Springfield and to the crossing of the two roads west of the city, a distance of about 7 miles in all. The New York, Pennsylvania & Ohio track runs about 2½ miles from the city, which is a busy manufacturing town with a large freight business.

New York, New Haven & Hartford.—The statements to the Railroad Commission give the following figures for the quarter ending June 30 and the nine months of the fiscal year from Oct. 1 to June 30:

	Quarter.		Nine months.	
	1885.	1884.	1884-85.	1883-84.
Earnings	$1,664,362	$1,706,486	$4,845,074	$4,903,003
Expenses	1,011,007	1,078,329	2,918,154	3,183,265
Net earnings	$653,355	$628,157	$1,926,920	$1,719,738
Other income	4,629	4,684	9,423	14,179
Total	$657,984	$632,841	$1,936,343	$1,733,917
Charges	204,947	237,873	614,841	899,774
Surplus	$453,037	$394,968	$1,321,502	$834,143

Charges include interest, taxes and rentals. The gross earnings for the nine months this year were equivalent to 8½ per cent. on the stock. The dividends paid have been at the rate of 10 per cent. yearly, or 7½ per cent. for the nine months.

New York, West Shore & Buffalo.—On Aug. 11 Messrs. Drexel, Morgan & Co. issued the following notice:

"Having received the assent of more than a majority of the $50,000,000 first-mortgage bonds of the New York, West Shore & Buffalo Railroad Co., to the plan of reorganization and lease contained in our circular of July 25, 1885, we hereby give notice that we shall terminate at the close of business on Tuesday, Aug. 25, the privilege of accepting the offer therein made. Foreign holders can deposit bonds up to that date with Messrs. J. G. Morgan & Co., in London. Temporary receipts will be exchanged for engraved receipts in amounts of $1,000 and $10,000 each upon presentation at our office on and after Aug. 20."

The exact amount of bonds assented is not known, but rumor puts it at nearly $30,000,000. Probably others, who have been waiting, will come in now that a majority has been secured.

Northern Pacific.—The following statement is made for June and the fiscal year ending June 30:

	June.		Year.	
	1885.	1884.	1884-85.	1883-84.
Earnings	$1,012,507	$1,143,123	$11,234,149	$12,603,575
Expenses	447,620	607,228	5,953,800	6,922,525
Net earnings	$564,887	$535,895	$5,280,349	$5,681,050

For the year this shows a decrease in gross earnings of $1,369,426, or 10.9 per cent., and a decrease in expenses of $968,725, or 13.9 per cent.; the result being a decrease of $400,701, or 7.1 per cent., in net earnings.

Omaha Belt.—This company was organized some time ago to build a belt or transfer line around the city of Omaha, Neb. The money to purchase the right of way and build the road was advanced by the Union Pacific, but all the work was done and bids taken in the name of S. H. H. Clark, J. M. Eddy and Frank Murphy, as officers of the company. Recently it is charged that the directors of the company have made an arrangement to issue additional stock and secure entire control, throwing out the Union Pacific altogether. On Aug. 7, therefore, the attorney for the Union Pacific Co. applied to the Circuit Court and obtained an injunction restraining Messrs. Clark, Eddy and Murphy from voting on any stock or taking any action whatever as officers or directors of the Omaha Belt Line Co. The injunction is temporary, and the case will be heard on its merits at the next term of the court.

Oregon Improvement Co.—This company's statement for June and the seven months of the fiscal year from Dec. 1 to June 30 is as follows:

	June.		Seven months.	
	1885.	1884.	1885.	1884.
Gross earnings	$222,442	$278,516	$1,591,419	$1,932,547
Expenses	177,049	208,089	1,290,537	1,497,738
Net earnings	$45,393	$70,427	$300,882	$434,809

For the seven months the gross earnings decreased $341,128, or 17.6 per cent., and the expenses $207,201, or 13.8 per cent., leaving a decrease of $133,927, or 30.8 per cent., in net earnings.

Oregon & Transcontinental Co.—A circular issued in Boston contains the following information respecting the condition of the Oregon & Transcontinental Co.: It owns 145,000 shares of Oregon Railway & Navigation stock, worth (at 79½) $11,527,000; 90,750 shares of Northern Pacific preferred (at 47), $4,265,000; 112,119 shares of Northern Pacific common (at 22), $2,467,000; miscellaneous assets, $3,500,000; total, $21,759,000. Debt funded to 1886 at 8 per cent., $8,000,000; floating debt, 4½ per cent., $3,500,000; total debt, $11,500,000. There are $9,953,000 bonds upon all the branch lines of the Northern Pacific Railroad at $20,000 per mile. The current value of Oregon Navigation more than offsets the debt of $11,500,000, leaving $6,732,000 as the market value of Northern Pacific stocks and $3,500,000 of other assets, which makes the Oregon & Transcontinental stock figure 25½, against present market value of 20. The interest charges against the company on $11,500,000 are $640,000 on the $8,000,000 and $157,600 on the $3,500,000; total, $797,600. They say a dividend of 5 per cent. on Oregon Navigation will yield the company $726,460, and its income from other sources is $100,000—$826,400—which will take care of interest charges. Among the miscellaneous assets is a block of 18,714 shares of Wisconsin Central common.

Pennsylvania & Martin's Creek.—The stockholders met in Philadelphia Aug. 12, and voted to dissolve the company, which was organized to build a road from the slate quarries near Bangor, Pa., to connect with the Belvidere Division of the Pennsylvania Railroad.

Philadelphia & Reading.—It is said that considerable pressure is being brought to bear on this company to prevent the completion of the agreement for the use of its line between Philadelphia and New York by the Baltimore & Ohio. The direct interest in the stock held by parties opposed to the agreement is aided by threats of sharp competition from the Pennsylvania's new parallel line, and of the extension of that line into the Schuylkill coal district, and every possible influence will be used to shut out the Baltimore & Ohio from the road.

Pittsburgh & Neville Island.—A suit has been begun by J. F. Pennant and other stockholders against J. H. McCreery and others, directors, asking for an accounting and for the appointment of a receiver for the company. The complaint charges that shortly after the organization of the company, about a year ago, a contract was let to J. H. McCreery to build the road, which was to be a short suburban line running out of Pittsburgh about 6 miles, payment to be made in $100,000 stock and $150,000 bonds of the road. The stock and bonds, it is charged, were issued to McCreery and converted by him to his own use, but he has done nothing toward the construction of the road. It is further charged that certain of the directors have conspired to defraud the stockholders and to use the securities of the company for their own purposes.

Sabine Pass & North Texas.—An effort is being made to revive this project. The company was organized some time ago to build a railroad from Marshall, Tex., to Sabine Pass, about 230 miles, but work was stopped after a few miles had been graded.

Scioto Valley.—The committee representing the first mortgage bondholders has addressed a circular to the bondholders, stating that formal notice has been sent to the trustee, the Fidelity Insurance & Trust Co., requesting it to begin proceedings in foreclosure to take possession of the mortgaged property. This action the committee believes to be the best for the interest of the bondholders, and also believes that it will meet with general approval.

Sonoma Valley.—The Sonoma Valley and the Sonoma & Santa Rosa companies have been consolidated under the name of the Sonoma Valley Railroad Co. The company proposes building a line from Santa Rosa, Cal., through the Guilicos Valley, to Sonoma, and thence through Norfolk to the mouth of Tolay Creek on San Pablo Bay.

South Pennsylvania.—It is reported that a number of land owners along the line of this road who have given the right of way will, if the road is abandoned, seek redress in the courts. They claim, it is stated, that they gave the land with the contract that the road should be built as rapidly as possible, and that their interests would be seriously damaged by its abandonment.

Toledo, Cincinnati & St. Louis.—A report recently filed by the Special Master in this case recommends that the Court declare the terminal bonds invalid. The Master finds, from the evidence submitted, that all the property acquired by the Toledo, Delphos & Burlington Co. after Jan. 17, 1880, is embraced in and is part of the property described in the mortgage of that date, and was conveyed in trust to secure the issue of $1,250,000 first-mortgage bonds, subject only to purchase money liens, upon specified pieces of property which are enumerated in the report.

Toledo, Peoria & Western.—The bondholders' committee requests all first mortgage bondholders to deposit their bonds with the Farmers' Loan & Trust Co. in New York by Aug. 14. They are also requested to pay an assessment of $5 per bond to meet the expenses of the committee.

Union Pacific.—The Treasurer of this company offers to purchase on behalf of the company, on or before Aug. 31 next, any or all of the outstanding land grant bonds on the following terms: Bonds due April 1, 1887, at 104½ flat; bonds due Oct. 1, 1888, at 109½ flat, and bonds due April 1, 1889, at 110½ flat.

Utica & Black River.—This company's report to the New York Railroad Commission, for the quarter ending June 30, shows gross earnings of $187,467. The net income for the quarter, after paying operating expenses, rentals and interest, was $34,846. For the corresponding quarter last year the gross earnings were $199,193, and the net income $3,854.

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Louisiana & Missouri River.

The directors of this company, the operations of whose road are incuded in the Chicago & Alton report, make the following report to the stockholders for the year 1884:

"Length of road is 100.9 miles, viz.: The main line, between Louisiana and Mexico, is 50.9 miles; South Branch, between Mexico and Cedar City, 50 miles.

"The company's liabilities are as follows:

Capital stock, common	$2,272,700
Capital stock, preferred	1,010,000
Guaranteed pref-rred stock and bonded debt	1,974,100
Balance principal and interest of notes due Chicago & Alton Co., Dec. 31, 1884	200,479
Total	$5,457,279

"In addition to the above liabilities, the first mortgage bonds of the company, to the amount of $439,100, are outstanding, on which the Chicago & Alton Railroad Co. has agreed to pay the semi-annual interest as it accrues, and the principal upon the maturity of the bonds. This undertaking on the part of the Chicago & Alton Railroad Co. was made when it was found this company could not complete its line west of Mexico, and was in consideration of the transfer to that company by the Louisiana & Missouri River Railroad Co. of rails and other material then on hand, to provide for the payment of which these bonds had been issued when it was expected this company would extend its line to Kansas City.

"On Aug. 1, 1870, the road of your company was leased to the Chicago & Alton Railroad Co. in perpetuity, reserving an annual rental of 35 per cent. of the gross earnings, after deducting taxes and assessments, with the stipulation, on the part of the Chicago & Alton Railroad Co., that the minimum rental should never be less than $1,370 per mile per annum."

The income account for the year was as follows:

Gross earnings of road, less taxes		$665,903
Rental, 35 per cent. of gross earnings		$233,066
Interest paid	$115,150	
Dividends on preferred stock	23 100	
Sundry accounts	2,016	
Account bills payable, Chicago & Alton Co	92,800	
		233,066

Of the total gross earnings, the main line furnished $627,121, and the South Branch $53,993, a total of $681,114. Taxes were $15,211, leaving a balance of $665,903, as above.

Memphis & Charleston.

This company owns a line from Memphis, Tenn., to Stevenson, Ala., 272 miles, with branches to Somerville, Tenn., 14 miles, and to Florence, Ala., 6 miles. Its trains use the Nashville, Chattanooga & St. Louis track from Stevenson to Chattanooga, Tenn., 38 miles, making 330 miles worked. A brief statement has been published for the year ending June 30 last.

The road is operated by the East Tennessee, Virginia & Georgia Co., under a lease which is now in litigation.

The earnings for the year were:

	1884-85.	1883-84.	Inc or Dec.	P.c.
Earnings	$1,384,906	$1,394,020	I. $9,114	0.7
Expenses	881,691	958,109	D. 76,418	8.0
Net earnings	$503,215	$435,911	I. $67,304	15.4
Gross earn. per mile	4,197	4,224	D. 27	0.7
Net " " "	1,525	1,321	I. 204	15.4
Per cent. of exps	63.7	68.7	D. 5.0	....

Expenditures, including interest on bonds, floating debt, part of principal and interest on car trusts, and steel rails purchased, were $677,369, the deficit thus being $174,154 for the year.

Texas & Pacific.

This company operates 1,487 miles of road, its lines extending from Shreveport, La., to Sierra Blanca, Tex.; Texarkana, Tex. to Fort Worth; Jefferson, Tex., to Marshall; Marshall to New Orleans. Its trains use the Galveston, Harrisburg & San Antonio track from Sierra Blanca to El Paso. The road is controlled by the Missouri Pacific and worked in connection with that company's lines. The report is for the year 1884.

There are 303 miles of the main line laid with steel rails. There are 131 miles of sidings on the line.

The equipment includes 166 locomotives; 80 passenger and 24 baggage, mail and express cars; 1,171 box, 545 stock, 984 flat and coal and 97 caboose cars; 4 business and pay cars and 73 road service cars.

The general account, condensed, is as follows:

Stock		$32,164,600
Funded debt		46,319,523
Bills and accounts payab'e		2,060,959
Land Department		2,490,708
Coupons deposited under agreement		542,130
Total		$83,577,920
Road and equipment, etc	$74,189,462	
Securities, bonds, etc	2,141,771	
Sundry accounts and balances, cash, etc	982,450	
Land notes receivable	991,929	
Land accounts	1,776,648	
Unadjusted balances	111,238	
Profit and loss, balance	3,384,422	
		83,577,920

The funded debt includes $3,784,000 Eastern Division firsts and $9,316,000 consols; $13,028,000 Rio Grande Division firsts; $6,720,000 New Orleans Pacific firsts; $8,862,000 income and land grant; $1,624,000 general mortgage and terminal; $6,000 old land grants; $2,813,558 scrip, and $165,965 Texas school fund loan.

The traffic reported is as follows:

	1884.	1883.	Inc. or Dec.	P. c.
Passengers carried	674,485	744,745	D. 70,660	9.5
Av. journey, miles	71.1	46.8	I. 24.3	50.2
Tons freight carried	1,056,726	946,219	I. 110,507	11.7
Av. haul, miles	232.1	273.7	D. 41.6	15.2

Earnings per train mile last year were, in cents, 114.96 gross and 15.23 net; per car mile, 12.42 gross and 1.64 cents net. The average rate per ton mile was 1.64 cents.

The earnings for the year were:

	1884.	1883.	Inc. or Dec.	P.c.
Freight	$4,037,484	$4,567,043	D $529,559	11.6
Passengers	1,375,383	1,575,670	D. 200,287	12.7
Mail and express	289,654	284,768	I. 4,886	1.7
Rents, etc	216,235	618,171	D. 401,936	65.0
Total	$5,918,756	$7,045,652	D. $1,126,896	16 0
Expenses	5,134,823	5,397,645	D. 262,822	4.9
Net earnings	$783,933	$1,648,007	D. $864,074	52.4
Gross earn. per mile	3,980	4,738	D. 758	16.0
Net " " "	527	1,108	D. 581	52.4
Per cent. of exps	83.8	76.6	I. 10.2	....

Included in expenses are $140,585 for improvements. Expenditures for betterments and additions to property, not included in expenses, were $174,712 for the year.

The income account is as follows:

Net earnings for the year		$783,933
Donated lands and town lot sales		51,385
Dividends received		77,739
Total		$913,057
Accrued interest on bonds	$1,970,190	
Taxes, rentals, etc	287,153	
		2,257,343
Deficit for the year		$1,344,286
Income account, debit balance, Jan. 1, 1884		2,040,136
Balance, debit, Dec. 31, 1884		$3,384,422

Renewals included 43 miles of steel rails, 314,049 new ties and 94 miles of ballast. There were 21 miles of new sidings built.

The Land Department reports sales of 544,984 acres (and town-lots) for $1,692,116. Payment was made $11,170 in cash; $943,298 in land notes and $737,648 in the company's bonds. The expenses were $64,992. Up to Dec. 31 last there were $428,000 land grant bonds paid off, $159,946 interest allowed, and $804,508 interest scrip received in payment for lands; a total of $1,392,454. There are 3,893,704 acres unsold, about three-fourths being of value for grazing only.

The report refers at length to the agreement for funding coupons and the negotiations through which the bondholders received a representation in the board. A full account of these has heretofore been given.

The loss in gross earnings was due to depression of business from light crops; the stoppage of traffic on the New Orleans Division by high water; the loss of transcontinental traffic by the completion of the Southern Pacific, and the increased competition for local business. The loss of the Pacific traffic caused a decrease in the average haul, while lumber traffic

and the opening of the New Orleans Division in the fall caused an increase in tonnage. The report says:

"The rates upon through and competitive traffic present a fair comparison with those of previous years; but the decrease in the movement of the higher class of freight traffic, and the efforts to develop local business, have decreased the average local rate heretofore received. The increase in the total number of passengers carried exhibits, however, that the country tributary to the road is still developing, and, with the inducements in the future of good crops and business prosperity, a continued large growth is yet to be expected.

"The New Orleans Division, however, was continued in operation, for the first time since its construction, during the last four months of the year, the heaviest period of the cotton traffic, greatly facilitating the traffic of all divisions, and exhibiting the value of that division to the company, if it could be maintained and operated in good condition, for the entire year. The property is generally in good condition, with the exception of the old iron rail requiring replacement by steel, and ballast to be placed upon portions of the road-bed.

"At the Gouldsboro terminal, opposite New Orleans, the company has had large losses in wharves, depots and tracks, by reason of the erosion of the river; and at present the government engineers are unable to state whether the protections which the company has placed, and the government is working upon, will enable the company to hold its property securely in Gouldsboro; therefore everything upon the west side of the river is of a temporary character, and must continue so until the ability to maintain the property is definitely decided. On the east bank, at New Orleans, the terminals are in fair condition, and ample for the business at present.

"The entire New Orleans Division, from Cheneyville to New Orleans is subject to overflow from high waters of the Mississippi, and it is a serious question whether any expenditure of the company can make it a permanent work without the concentrated aid of the state or general government in protecting and perfecting the levees of the Mississippi, the Red River and tributary bayous. Some 70 miles of the embankment must, however, be raised the entire distance, ballasted, and additional openings made to operate it to the benefit of the public and stockholders; but it will at all times be subject to the overflows of the river unless protected as above suggested.

"At the previous meeting of the stockholders promises were made to the owners of the branch road from Prudhomme to Natchitoches, that the company would furnish the superstructure, upon proper compensation, to complete the 11-mile branch in question. Nothing has been done to this end, and the people of that town are solicitous that the promises held out shall be complied with. The completion of this branch would add to the traffic of the company, and cause a better feeling to exist between the corporation and the people.

"The lease of the road-bed from Shreveport west to the Texas state line expired on Dec. 31, 1884, but during the past fall another lease was consummated between this company and the Vicksburg, Shreveport & Pacific Railway, upon terms which were considered of greater advantage to this company.

"During the year portions of the agreement originally made between Messrs. Gould and Huntington, affecting the traffic between El Paso and New Orleans, were not complied with on the part of the Huntington system, although every effort was made to enforce the contract. Since the close of the year modifications of the contract in question have been made, which are considered to be to the advantage of the company in settling all matters in dispute, and from which it is believed additional profits will be adduced during the year 1885.

"The floods of 1884 were more disastrous to the Texas & Pacific Railway than those of any previous year, and besides decreasing the gross revenue of the company, added large amounts to the cost of operation and maintenance."

Missouri Pacific.

At the close of the fiscal year, Dec. 31, 1884, this company worked the following lines held either by ownership or lease:

	Main track.	Sidings.
Missouri Pacific	995	234
Central Branch, Union Pacific	388	36
Missouri, Kansas & Texas	1,386	144
International & Great Northern	775	84
Galveston, Houston & Henderson	50	24
Texas & Pacific	1,487	131
St. Louis, Iron Mountain & Southern	923	219
Total Missouri Pacific system	6,004	872

Additions during the year were the extension of the Jefferson City, Lebanon & Southwestern Branch of the Missouri Pacific from Cooper, Mo., to Bagnell, 5 miles, and the building of the Jackson Branch of the Iron Mountain from Allenville, Mo., to Jackson, 18 miles. There were also added 60 miles of sidings.

Of the total 6,004 miles of road 3,285 miles, or 54.7 per cent., are laid with steel rails. The Jackson Branch is to be extended south to a point on the Knobel Branch, forming a loop or second line into Arkansas.

The equipment of the roads worked is as follows:

	Locomotives.	Pas. train cars.	Freight cars.	Service cars.
Mo. Pacific	164	115	5,527	29
Central Br	30	23	569	8
Mo., Kan. & Tex.	161	89	4 098	15
Int. & Gt. No.	74	53	1,410	44
Galveston, H. & H.	15	17	159	22
Texas & Pacific	166	108	2,797	73
St. L., I. M. & So.	147	98	4,501	28
Total	736	503	19,061	219

The company also owns five steam ferry-boats in use transferring cars at Carondelet, Cairo, Belmont and New Orleans.

There are 30 locomotives, 18 passenger and 2,200 freight cars held under the car trusts, on which $702,930 are still payable.

There were bought or built last year 26 locomotives; 8 immigrant cars; 500 box, 500 coal and 64 caboose cars.

The general account of the Missouri Pacific Co. is as follows, condensed:

Stock (inc. exchanges for Iron Mt. stock)	$29,974,800
Funded debt	28,895,000
Interest and accounts payable	2,513,958
Sundry accounts	141,542
Income account, balance	4,884,794
Total	$66,410,094
Road and equipment	$40,618,132
Stocks and bonds	21,776,607
Supplies	1,094,682
Accounts receivable	2,343,359
Cash	577,844
	66,410,094

The funded debt includes $7,000,000 firsts; $2,573,000 seconds; $800,000 real estate bonds; $3,828,000 thirds; $700,000 St. Louis County loan; $1,294,000 branch line firsts; $12,700,000 consolidated bonds.

The funded debt was increased last year by $2,000,000 consols. Stock was increased by $12,675 during the year.

TRAFFIC.

The locomotive and car mileage of the several lines was as follows:

	Loco. miles.	Pas. car miles.	Ft. car miles.
Mo. Pacific	5,866,195	7,947,248	56,099,117
St. L., I. M. & So	5,117,118	6,965,607	52,168,498
Mo., Kan. & Tex.	6,311,368	7,190,267	70,891,757
Int. & Gt. No	2,441,810	3,396,101	19,161,069
Gal., H. & H.	304,694	470,270	1,481,728
Tex. & P.	5,148,585	6,142,471	41,487,841
Central Branch	1,059,750	994,437	9,828,736
Total	26,249,520	33,288,675	251,112,716

There was an increase in train and car mileage on all except the three Texas lines, which show a decrease, like nearly all the roads in that state last year.

The traffic carried was as follows:

	1884. Number.	1884. Av. miles.	1883. Number.	1883. Av. miles.
Passengers:				
Mo. Pacific	1,757,862	45.8	1,567,863	49.5
St. L., I. M. & So	1,216.240	44.1	1,028,943	51.2
Mo., Kan. & Tex.	935,915	61.2	793,808	70.4
Int. & Gt. No.	434,159	54.0	492,172	56.6
Gal., H. & H	83,939	34.7	91,195	37.1
Tex. & P.	674,085	71.1	744,745	46 8
Central Br	197,866	46.2	164,743	48.1
Total	5,300,066	54.5	4,883,289	59 9
Tons freight:				
Mo. Pacific	2,839,524	147.7	3,270,721	136 7
St. L., I. M. & So.	1,611.221	238 9	1,557,954	239.0
Mo., Kan. & Tex.	2,271,387	181.5	2.130.894	197.0
Int. & Gt. No.	615.864	184.5	593,452	200.3
Gal., H. & H.	145,049	48.4	189,190	48.8
Tex. & P.	1,056,726	232.1	946,219	273.7
Central Br.	447,015	150.9	371,556	1 3.7
Total	8,9 6,786	249.8	9,059,986	236.6

There was a decrease in the average passenger journey, but an increase in the freight haul. The Missouri Pacific and the Galveston, Houston & Henderson are the only lines showing a decrease in total tonnage.

The traffic of all the lines compares as follows:

Train miles	1884.	1883.	Inc. or Dec	P. c.
Passenger	7,024,997	6,762.791	I. 262,206	3.9
Freight	13,177,745	18,121,322	D. 4,943,577	27.3
Pass. carried	5,300.066	4.883,289	I. 416.777	8.5
Pass.-miles	288,853,597	292,509,011	D. 3,355,414	1.3
Tons carried	8,986,786	9,059,986	D. 73.200	0.8
Ton miles	2,244,899,143	2,143,592,688	I. 101,306,455	4.7
Av. train load:				
Pass., No.	41	43	D. 2	4.7
Freight, tons	170	118	I. 52	47.1

The most remarkable feature in this statement is the great decrease in freight train mileage on a slight increase in traffic carried.

The total coal tonnage for the year was 1,517,259, of which 1,002,972 tons were mined on the lines and 514,287 received from other lines. Of the total tonnage 915,439 tons were for the company's use, and 601,820 tons were commercial coal. The gross earnings on this coal tonnage were $1,483,328, of which $1,055,385 were charges on commercial coal, which thus furnished 71.2 per cent. of the revenue, with 39.7 per cent. of the tonnage. The average cost to the company of the coal used on its lines was $2.24 per ton.

EARNINGS.

The earnings of the Missouri Pacific proper were:

	1884.	1883.	Inc. or Dec.	P. c.
Freight	$6,047,339	$6,469,640	D. $422,301	6 5
Passengers	2,043,457	2,085,287	D. 41.830	2.0
Mail and express.	442,133	430,868	I. 11.265	2.6
Rents, etc	244,698	167,936	I. 76,762	45.7
Total	$8,777,627	$9,153,731	D. $376,104	4.1
Expenses	4,492,877	4,978,465	D. 485,588	9.7
Net earn	$4.284,750	$4,175,266	I. $109,484	2 6
Gross earn. per m	8,822	9,246	D. 424	4.6
Net earn. per m.	4,307	4,217	I. 90	2.1
Per c. of exps.	51.2	54.4	D. 3.2	

The decrease in earnings was somewhat more than offset by that in expenses, leaving a slight gain in the net earnings for the year.

The income account of the Missouri Pacific was:

Net earnings, as above		$4,284.750
Dividends received		172,780
Miscellaneous accounts		34,042
Total		$4,491,572
Interest on bonds	$1,798,200	
Taxes, rentals, dividends, etc	2,873,141	
		4,671,341
Deficit for the year		$179,769
Balance, Jan. 1, 1884		5,064,563
Balance, Dec. 31, 1884		$4,884,794

The dividends paid on the stock were 7 per cent. In 1883 the surplus over all payments was $429,401.

The earnings of all the lines were as follows:

	Earnings.	Expenses.	Net earnings.
Mo. Pacific	$8.777.627	$4,492,877	$4,284,750
St. L., I. M. & So	7.451,897	3,987 298	3,464,599
Mo., Kan. & Tex.	7.317 251	4,347.247	2,790,004
Int. & Gr. No.	3,041,587	2,416.865	624,722
Gal., H. & H.	289.119	317,977	*28,858
Tex. & P	5,918,756	5,134.823	783.933
Central Br.	1,718,130	1,035,286	682,844
Total	$34,514,368	$21,732,375	$12,781,993
Total, 1883	37,278,726	22.981,150	14,297,576
Decrease	$2,764,358	$1,248,775	$1,515,583
Per cent	7.4	5.4	10.6

*Deficit

There was a decrease in gross earnings on all the lines except the Central Branch. A general reduction in expenses was not sufficient to offset this and there was a net decrease on all except the main line and the Central Branch.

The earnings per mile and the proportion of expenses to net earnings were as follows:

	Earn. per mile. 1884.	1883.	Net per mile. 1884.	1883	P. c. of exps. 1884.	1883.
Mo. Pacific	$8,8:2	$9.246	$4,307	$4.217	51.2	54.4
St L., I. M. & So.	8.189	8,852	3,807	4,132	53.5	53 3
Mo., Kan. & Tex.	5,279	5,684	2,143	2,317	59.4	59 2
Int. & Gt. No.	3,886	4,434	806	1,231	79.5	72.2
Gal., H. & H	5,982	7,797	.....	.....	110.0	110.8
Tex. & Pac	3,980	4,738	527	1,108	86.8	76.6
Central Br.	4,428	3,880	1,760	1,740	60.3	55.2
Total	$5,765	$6,252	$2,135	$2,398	63.0	61.7

Renewals on all the lines included 311 miles of steel rails and 1,670,638 new ties; 64 miles of new sidings were built. The amount expended for extraordinary improvements (and included in working expenses) was $814,838.

LAND DEPARTMENT.

Some statistics of the Land Department for the year are as follows:

	Mo., Kan. & Tex.	Iron Mt., Mo.	Iron Mt., Ark.	Tex. & P.
Sales, acres	4,914	1,564	34,242	551,473
" amount	$17,051	$6,569	$115,464	$1,735,787
Cash received	111.432	11.822	94,946	67,408
Land notes held	169,105	21,885	727,450	1,152,586
Acres unsold	2,078	114,166	895,652	3,965,025

Land sales from the Texas & Pacific grant were largely paid for in bonds. The Texas sales increased considerably.

GENERAL REMARKS.

The report says: "The principal cause for the decrease of gross earnings was the general depression of business throughout the entire country, although floods and failure of crops in certain districts, together with increasing local competition, contributed to the same result.

"The gross tonnage moved nearly equaled the amount of the previous year, indicating that the development of the country was progressing, although the decrease in the higher classes of freight and the increase in competition reduced the average rate received.

"The construction of competing lines—the narrow-gauge system in Arkansas and Texas and the extension of the Kansas City, Fort Scott & Gulf to Memphis—decreased tonnage and revenue. The opening of the new transcontinental routes and consequent demoralization of rates deprived the properties of a formerly lucrative California, Arizona and New Mexico business, but arrangements effected since the close of the year will, it is hoped, result advantageously.

"In Texas the cotton and grass crops were failures in the central, southern and western parts of the state, by reason of the drought; the cotton movement of the past year aggregating only 976,170 bales, against 1,159,780 in 1883. The grain crop was generally above the average, but low prices retarded its movement to market, and prevented the producer from bringing in return those articles which constitute the most profitable tonnage for transportation. The same causes decreased the revenue from passenger traffic.

"Upon the St. Louis, Iron Mountain & Southern the reduction of passenger rates from 5 cents to a maximum of 3 cents per mile in Arkansas on Oct. 1, 1883, decreased the passenger earnings, and also affected the through rates to points beyond.

"The increase in passengers carried and the very slight decrease in the freight tonnage moved, with the losses by floods, prevented the reduction of expenses proportionately with the decrease in earnings; but the cost of performing similar work was less than that of the previous years."

Below are given statements of capital and income for the several lines, excepting the Texas & Pacific, whose report is given separately, and the Central Branch, which is worked by this company for account of the Union Pacific:

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.

The general account is as follows:

Stock		$22,082,445
Funded debt		35,564,338
Accounts and balances		3,025,792
Income account, balance		1,684,952
Total		$62,357,527
Road and equipment	$53,559,495	
Land grants	2,951,440	
Investments in stocks and bonds	5,846,592	
		62,357,527

The income account for the year was as follows:

Net earnings	$3,464,599
Other receipts	44,727
Total	$3,509,326
Interest, taxes, rentals, etc	2,760,947
Surplus for the year	$748,379
Balance, Jan. 1, 1884	936,573
Balance, Dec. 31, 1884	$1,684,952

This road suffered from wash-outs and high water, which damaged the main line and stopped traffic for weeks on some of the branches.

MISSOURI, KANSAS & TEXAS.

The general account, condensed, is as follows:

Stock (including $8,676 preferred)		$46,414,676
Funded debt		41,657,185
Accounts and balances		2,109,859
Total		$90,181,719
Road and equipment	$66,457,085	
Stocks and bonds	18,495,719	
Other investments, cash, etc	1,826,276	
Income account, debit balance	3,402,639	
		90,181,719

The income account for the year was as follows:

Net earnings, as above	$2,970,004
Other receipts	457,419
Total	$3,427,423
Interest, taxes, rentals, etc	2,919,278
Surplus for the year	$508,145
Debit balance, Jan. 1, 1884	3,910,784
Debit balance, Dec. 31	$3,402,639

The main line is now all laid with steel rails, except 13 miles. The iron rails on some of the branches are old and need replacing.

INTERNATIONAL & GREAT NORTHERN.

The general account of this company was as follows:

Stock		$9,755,000
Bonds		15,008,000
Accounts		756.973
Income account		2,658,770
Total		$28,178,743
Road and equipment	$27,927.423	
Investments, cash, etc	251,320	
		28,178,743

The income account for the year was as follows:

Net earnings for the year	$624,722
Other receipts	28,971
Total	$653,693
Interest, taxes, etc	1,059,707
Deficit for the year	$406,014
Balance, Jan. 1, 1884	3,064,784
Balance, Dec. 31, 1884	$2,658,770

Expenses on this line were somewhat increased by heavy wash-outs, requiring a considerable outlay for repairs.

GALVESTON, HOUSTON & HENDERSON.

This company's financial statement is as follows:

Stock		$1,000,000
Funded debt, first-mortgage bonds		2,000,000
Accounts and balances		146 902
Total		$3,146,902
Road and equipment	$3,000,000	
Income account, balance	146,902	
		3,146,902

The income account for the year was:

Deficit in earnings for the year	$28,860
Interest, etc	108,815
Total	$137,675
Rentals received	60,281
Total loss for the year	$77,394
Debit balance, Jan. 1, 1884	69,508
Debit balance, Dec. 31, 1884	$146,902

No special work was done on this line last year, and renewals were light. Traffic has been largely diverted from the road, which was formerly profitable.